THE ELECTRICAL WORLD

A Weekly Review of Current Progress in Electricity and its Practical Applications

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The Electric Railway at the Chicago Exposition.

It is not too much to say that the electric railway which was in operation at the recent exposition of railway appliances at Chicago constituted the leading novelty and one of the chief features of attraction of that magnificent display of the sciences and arts applied to the railroad. We may go even further and say that a railway exposition on such a grand scale would have been incomplete had it failed to embody the electric railway—the latest development of the art, the newest phase of evolution of the locomotive. The locomotives of the past were there—cumbrous, clumsy specimens of mechanical construction which left one in doubt whether such crude affairs ever did or could move themselves without assistance. Th

tive could boast of such a successful performance, surely the products of the future Rogers and Baldwins of electric railway construction would surpass all anticipations of success. The electric railway at Chicago has already been described briefly by the scientific press throughout the country, but we have purposely delayed giving any detailed description until the present time, in order to be able to produce a complete and satisfactory account of it, accompanied by a series of original illustrations and diagrams, which we take pleasure in presenting to our readers this week.

When we consider the remarkably short time in which this electric railway was constructed and put in operation, it seems like a great achievement. The Electric Railway Company of the United States, which was formed to

results. It is, indeed, a matter of surprise that an electric railway was produced at all from the resources available in that time, and it reflects the greatest credit upon Mr. Frank B. Rae, one of the electrical engineers of the company, who had charge of the enterprise, and Mr. Clarence L. Healy, his assistant, who personally attended to many details.

As the short time did not permit of the construction of dynamo-electric machines especially adapted to perform the functions of generator and motor, some Weston machines were procured for this purpose from the United States Electric Lighting Company, of New York, which had an exhibit at the exposition. The same type of machine was used as generator and as motor. It was what is known as the No. 6 Weston 100 incandescent light ma

FIG. 1.—THE ELECTRIC LOCOMOTIVE AT THE CHICAGO EXPOSITION.

locomotive of the present was also there, under many a type—marvels of engineering science and skill from the Rogers, the Baldwin and all other locomotive works of the land, all vieing with each other in perfection of design and beauty of workmanship. The locomotive of the future—the electric railway—was therefore needed to complete the list. It did not appear there to best advantage; for we shall see presently that it was called into existence for the occasion, at very short notice and under adverse circumstances. Still, it answered every purpose as a suggestion of the great capabilities which lie in its way. The visitor who had followed the history of the steam locomotive by passing successively from the oldest type to the youngest, and now paused before the electric locomotive in wonder, could scarcely refuse to believe that here was a new and higher plane of evolution, of which the specimen before him was but the merest beginning—the protoplasm. And involuntarily the conviction came to his mind that if the earliest and crudest electric locomo-

acquire and consolidate the Field and Edison patents, did not properly come into existence until about the beginning of May. The project of exhibiting at the Chicago exposition had been entertained, but it was not until two weeks before the opening of this exposition that it was definitely decided that the electric railway should form one of its features. Everything remained to be prepared. The locomotive was scarcely begun, and the track was not laid. But the work was put under way and pushed with vigor. It is needless to say that the electric railway, under the circumstances, does not fairly represent the inventions of Messrs. Field and Edison, because the short time allowed to complete preparations left no other alternative than to make use of such electrical apparatus and material as could be readily and conveniently procured in the market without stopping to inquire too closely into its fitness for the purpose, and then to design everything else to suit its electrical and mechanical peculiarities. Under the circumstances, it was impossible to hope for great efficiency or economy of

chine, having an electromotive force of about 75 volts at its normal speed of 1,100 revolutions, and producing a current of about 150 ampères through its normal circuit resistance of .5 ohm. Its weight was 2,700 lbs. This electromotive force was comparatively low, and it was necessary to use great care to make the resistance of the track and connections a minimum.

Our front page illustration represents the electric locomotive "The Judge" upon the track. The passenger car, which was similar in appearance to an open street car, is not shown. The locomotive was styled "The Judge" by Mr. Field himself, who claimed the privilege of baptizing this child of his genius, in honor of his uncle, Chief Justice Field.

The track (Fig. 2) on which "The Judge" ran was laid in the gallery of the main building, extending around its margin, and curving sharply at either end on a radius of 56 feet. Its total length was 1553 feet, or nearly one-third of a mile. This track, which was of three-foot gauge, was

composed of three rails, in accordance with Mr. Field's method of conveying the current to the motor of the locomotive. The middle or central rail was connected with one pole of the stationary generator located below on the main floor, at a distance of about fifty feet from the track. The two outside tracks were electrically connected together and with the other pole of the generator, as shown in the figure. This arrangement obviated the necessity of insulating the wheels on one side from those on the other, which is necessary when only two rails are used, as, for instance, in the railway now being laid between Bloomfield and Newark, in which case each rail is connected to one pole of the stationary generator.

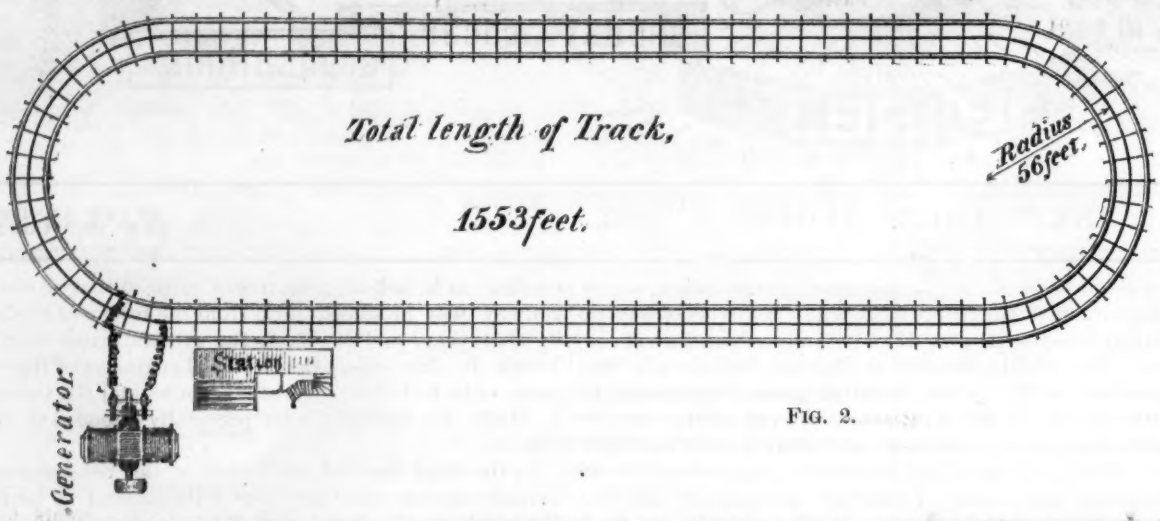

Fig. 2.

The method of Mr. Field presents peculiar advantages, for it enables the electric locomotive to be adapted with little trouble to existing railroads, a result which would be practically unattainable by the other method, on account of the expense and the inconvenience of changing the wheels so as to make those of one side insulated from those of the other. Even the complication of construction of the wheels and axles which this method entails would be an objection, while the liability to derangements from short circuits would probably be much greater.

In order to secure a low resistance and proper connections between all the rails, a precaution made necessary by the low electromotive force of the generator, wires were laid under each rail. The inside rail was wired with No. 6 (B. & S.) bare copper wire and the outside rail with No. 8 iron wire. The central rail was also wired with No. 8 copper wire. A good contact was made with each rail by proper fastenings at the joints and also by laying the wire under the rails in the supporting plates, so that the weight of the rail rested upon it. These precautions practically reduced the resistance of the line to a value so small as to be inconsequential. It need scarcely be said that if the electromotive force of the current used had been higher these precautions would not have been required, and a simple connection of the rails together without wires would have sufficed. With an electromotive force of 300 volts, for instance, to produce the same current, the addition of .25 ohm to the circuit resistance by the rails would not have produced a very marked lowering effect on the current delivered by the generator, but in this case it meant a reduction of one-third.

The internal construction of the locomotive will be readily understood from the accompanying figures (3, 4, 5, 6). Fig. 3 shows the locomotive in side elevation with its cab removed. Fig. 4 is a plan view of the same. These figures show the manner of transmitting the power from the armature of the motor to the driving wheels. The motor is placed crosswise upon the frame. Its armature shaft is coupled to an extension shaft which is prolonged forward and transmits motion by means of bevel gearing to a countershaft carrying two pulleys. From these pulleys the power is transmitted by means of belts to the loose pulleys on the axle of the drivers. It will be noticed that this arrangement throws the greatest weight directly over the driving wheels. The gearing up of the armature extension-shaft to the counter-shaft was made so as to reduce the speed three times. The pulleys on the counter-shaft were 12 inches in diameter, the driven or loose pulleys on the axle of the drivers were 26 inches in diameter, and the car wheels, or drivers, were 30 inches in diameter. The maximum speed which this gearing would produce was about 12 miles per hour, but the weakness of the gallery upon which the track was laid made it necessary to run the locomotive at a lower speed. The average speed maintained was eight miles an hour, the motor revolving at the rate of about 750 turns.

Before proceeding further with the description it will be of interest and assistance to analyze briefly certain electrical conditions which rendered necessary the use of some of the mechanical devices which are yet to be described.

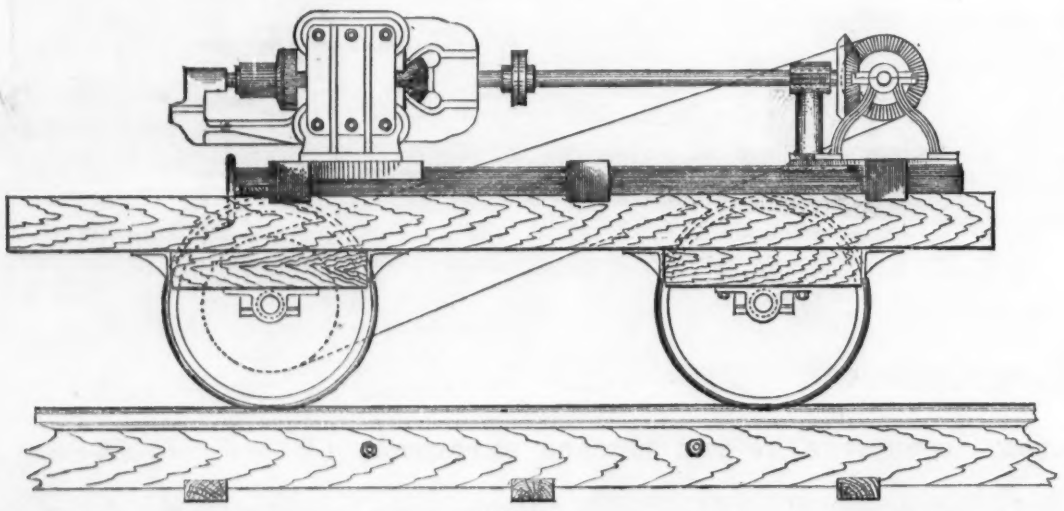

Fig. 3.

The two Weston machines used as generator and motor were of the "shunt wound" description, in which the current from the armature divides into two portions, one passing through the field magnet circuit and the other through the external circuit, the amount of current apportioned to each circuit being inversely proportioned to its resistance. When the resistance of the external circuit is great, a larger amount of current passes through the field magnet, and the magnetic field is made stronger. In this case the effect of opening the external circuit is precisely the same as if its resistance were increased to infinity: that is to say, all the current passes through the field magnets and the magnetic field attains its highest degree of power. On the other hand, when the resistance of the external circuit is reduced to almost nothing, the largest proportion of the current passes through the external circuit, leaving only a small portion to pass through the field magnets, and the magnetic field is very weak. Consequently, if we start a shunt generator with a closed external circuit of very low resistance, the small quantity of current induced in the armature by the residual magnetism of the magnetic field passes almost all into the external circuit, and the magnetism of the magnetic field fails to increase, so that the current developed remains small.

Now if, as in the case of the electric locomotive, the external circuit consists of a second machine to be worked as a motor, the resistance of which is very small, the generator will not develop current enough to start the motor. If, however, the leading wires add sufficient resistance to the external circuit to cause the diversion of an appreciable current into the derived or field magnet circuit of the generator, its magnetic field will increase in power and the current induced in the armature will consequently be greater in volume, and perhaps enough to start the motor. Consequently, it would appear expedient to increase the external resistance at the time of starting the generator, so that its magnetic field may be charged sufficiently. When the motor begins to move it develops a counter electromotive force in the circuit which practically amounts to so much electrical resistance and causes the further diversion of current into the magnetic field circuit. Thus, when once started, the counter electromotive force of the motor answered the purpose of resistance. It was found practically by Messrs. Rae and Healy in preliminary experiments with these two machines that the condition of best efficiency of the generator was realized when the motor had attained its maximum speed, and that the power developed was greater at that time. From this they inferred that the proper moment to put the load on the motor was when it had reached its greatest velocity.

The mechanism by means of which this was accomplished is quite ingenious and simple, as seen in Fig. 5, which represents a rear end elevation of the locomotive without the cab. The loose pulleys *G G* run on the axle of the drivers *W W*, as previously stated, motion being transmitted to them by belts from the pulleys of the countershaft, as already shown in Figs. 3 and 4. *F F F F* are cone friction pulleys fitting into the interior of the rim of the loose pulleys. These friction pulleys revolve with the shaft, being connected thereto by means of keys and keyways, which are loose, however, so that the friction pulleys can be free to slip lengthwise on the axle as they revolve. The hub of each friction wheel F_1F_1 carries a collar *E E* which is connected by arms *D D* to a lever *B* fulcrumed at *C* on a projection from another collar fitted around the shaft. The operation of this form of friction clutch will be readily understood. In the position shown the friction

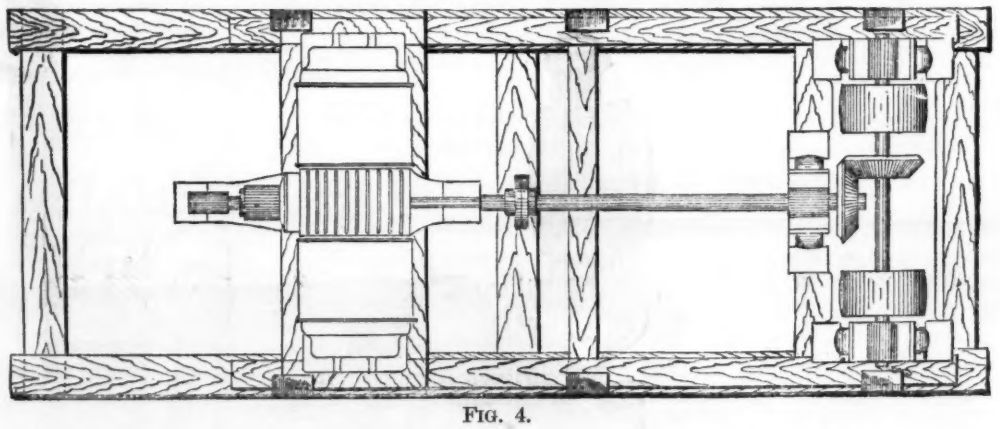

Fig. 4.

cones *F F* F_1 F_1 are removed from the pulleys, which are free to move loosely upon the axle. But upon moving the lever *B* to the right the friction cones are both moved outward from the centre, and caused to engage the inner surface of the pulleys, and thus the motion of the loose pulleys is communicated to the drivers *W W*.

As already stated, the central rail of the track formed one conductor and the two outside rails *R R* the other. The device for "picking up" the current was quite ingenious, and is also shown in Fig. 5. It consists of a kind of inverted vise firmly bolted to an arm *H H* projecting downward from the frame of the locomotive. The jaws *N N* of the vise are each perforated with three holes directed obliquely downward and inward, through which bundles of phosphor-bronze wire pass, being securely fastened and held by a screw *O*. A spring *S* extending between the arms of the vise serves to bring the two brushes *M M* into close and sure electrical contact with the central rail *P*. The wire being stiff and firm, the contact is equally certain whether the locomotive is moving forward or backward.

An important feature of this electric locomotive is the means by which the speed may be regulated at pleasure. In the original electric locomotive of Edison, at Menlo Park, and, indeed, in all the electric motors ever constructed, so far as we are aware, the only means of regulating the speed is by allowing the clutch to slip partially, the motor being permitted to run constantly at its wonted speed.

In the Chicago electric locomotive there is a "throttle-valve" arrangement resembling that found in every American locomotive, and which answers the same function; namely, to control the amount of force put in action. The nature of the device is as simple as it is efficient, and consists simply in a lever (Fig. 6) by the motion of which the resistance of a suitable rheostat may be thrown in and out of the main circuit with the evident result of controlling the amount of current flowing therein. The lever is placed horizontally and can move over contact segments disposed in a circle. These segments are insulated from each other, but they are connected by coils of iron wires so as to make a certain resistance, and possessing sufficient area of section to remain cool. Thus, when the lever is in the position shown in the figures, there is no resistance included in the circuit. When the lever is moved forward to

the next segment, the resistance added to the circuit is .1 ohm. On moving to the next the resistance added is .2 ohm, and so on, the amount of resistance included in circuit when the lever touches each segment being in Fig. 6 indicated by the figures thereon. The rheostat comprised two Edison *B* lamps of 85 ohms each, so that the total resistance when the lever touched the last segment was 174 ohms. It will be readily understood that by means of this device the amount of current in the main circuit could be easily varied.

The high resistance necessary at starting to cause the magnetic field of the generator to magnetize itself was readily afforded by this rheostat on closing the circuit. Another interesting feature of the Chicago electric locomotive is the device by means of which the current is reversed at the motor when it is desired to make the locomotive move backward (Fig. 7). The lever *J* causes the wheel *H H* to turn on the armature shaft *G*. This wheel gears with two wheels *E F*, to which are fastened arms *C C*, *D D*. These arms carry brush-holders and brushes A_1 A_2 B_1 B_2. The function of the device is simply to change the relative direction of the current through the armature of the motor. In the position shown in the figure the positive brush B_2 touches the commutator at the left-hand side, while the negative brush A_2 touches it at the right-hand side. On moving the lever *J* as far as *R* the brushes A_2 B_2 leave contact. On moving the lever still further the brushes *A B* now come in contact with the commutator of the motor, so that the positive brush B_1 touches the right-hand side of the commutator and the negative brush *A* the left-hand side, instead of the opposite. The result is necessarily a reversal of the direction of rotation of the armature of the motor.

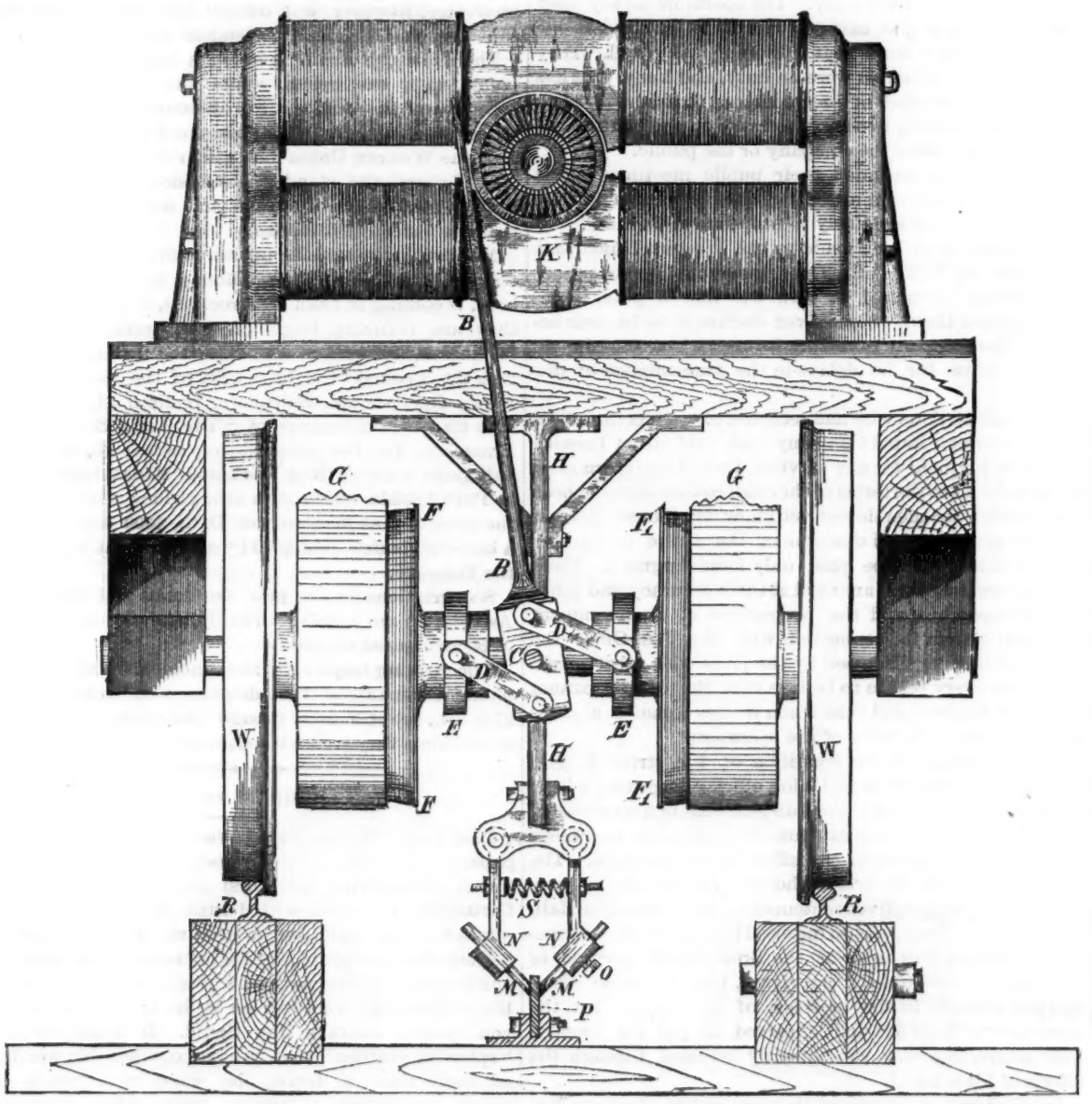

FIG. 5.

In this condition the motor is out of the circuit and receives no current. This is just the same as when the reversing lever of a steam locomotive is moved half way, thus cutting off the steam entirely by preventing the motion of the slide-valve.

The locomotive was also provided with an electric bell. This bell had a resistance of 350 ohms, and was rung by a switch which placed it in parallel circuit with the motor. Its high resistance prevented the diversion of the current from the motor in any appreciable quantity.

The locomotive was twelve feet long and five feet wide. Its total weight was about three tons. It was intended to be run with two passenger cars, but it was found upon inspection that the gallery was too weak to stand the strain. Even after having been strengthened, it was not deemed expedient to exceed the speed of nine miles an hour. The work of construction was done by the Excelsior Iron Works of Chicago, and the promptness and accuracy which characterized it are very creditable to the establishment.

The Chicago electric railway was the first constructed in this country for business purposes, and, considering the short lease of active life which was left to it after it was finally completed and put in operation, its success is most surprising. Owing to delay in receipt of the report of the engineer intrusted with the task of strengthening the gallery, the road was not permitted to operate for business until June 9, but experimental trips of the electrical locomotive were made daily from June 2.

Upon June 5 "The Judge" and its attached car loaded with 16 passengers (consisting of Commissioners of the Exposition and friends, all of whom were required to pay fare) was started by Mr. J. McGregor Adams and moved around the track. The railway was opened for business on June 9 and closed June 23, having run in all 118¾ hours and 446.24 miles.

The daily report of trips made, and passengers carried, is as follows:

	Trips.	Passengers.
Saturday, June 9	72	1,553
Monday, " 11	66	985
Tuesday, " 12	88	1,316
Wednesday, " 13	99	1,552
Thursday, " 14	109	1,372
Friday, " 15	108	1,567
Saturday, " 16	158	2,873
Monday, " 18	115	1,654
Tuesday, " 19	117	2,154
Wednesday, " 20	148	2,484
Thursday, " 21	142	2,829
Friday, " 22	172	2,886
Saturday, " 23	194	3,580
Totals	1,588	26,805

The success of the enterprise is due largely to the patronizing efforts of Mr. J. McGregor Adams, one of the Commissioners of the Exposition, who placed every facility at the disposal of the Electric Railway Company, and rendered every assistance in completing the arrangements.

"The Judge" has been sent to the Louisville Exposition, where an electric railway is being completed to be in operation during the continuance of the exposition just opened at that place. Mr. Adams is also interested in this new venture, and Mr. Frank B. Rae will be the electrician in charge same as at Chicago.

We regret that the uninterrupted operation of the electric railway during the last two weeks of the exposition precluded the possibility of making any measurements from which a definite idea of efficiency or of the cost of maintenance could be formed. We hope that better opportunies will present themselves at Louisville, and that the electrician in charge will not fail to satisfy the curiosity of the electrical world on this point.

The Electric Railway Company of the United States, as stated above, has control of the patents of Messrs. Field and Edison. The priority of invention of the former has been established in the Patent Office, and he has secured patents which virtually cover the fundamental principles and requirements of the art. The company is completing its preparations and will soon begin its work of development. A laboratory on a large scale will be established to facilitate the study of the best methods of adapting the

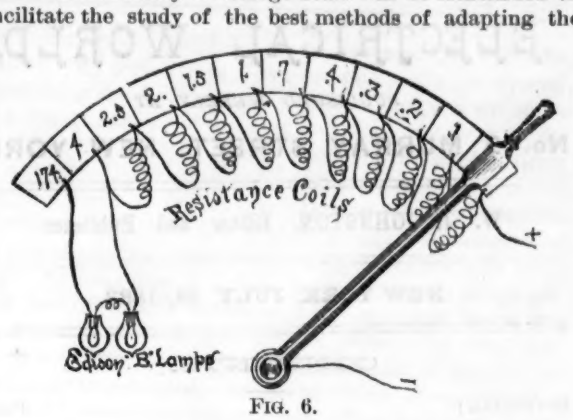

FIG. 6.

means to the ends desired, and experiments will also be tried on a working scale on various railway lines.

The Proposed New Cable.

Alderman Hadley, president of the new American, British and Canadian Cable Company, and prospective Lord Mayor of London, sailed for England on the 1st. He was in excellent spirits, his mission to this country having been quite as successful as he had dared to hope. Of course, he was interviewed almost on the gangway plank, as trans-atlantic travelers are sure to be. The tenor of his speech was that all contracts have been completed which insure for ten years cheaper facilities to people who wish to use the cable.

"We intend," said the beaming alderman, "upon my return to England to make immediate arrangements for the full completion of the entire system, and shall proceed by laying a cable from Penzance to Sable Island, and from that point to Halifax. At the latter place we shall be connected with the entire telegraphic system of the Dominion of Canada, and by a favorable arrangement just completed with the American Postal Telegraph Company we shall have direct communication throughout the United States.

"Our cable will be about 2,700 miles long and more direct than any at present existing. Eventually the company will have a cable running to New York. The capital stock is $1,500,000, and the greatest share of it is already subscribed. The new cable will be a few hundred miles shorter than the others; but it is our system of operation that will enable us to transmit messages rapidly and at very cheap rates.

"It would not be advisable to state just at present what our system is. This much I will say, however: it is entirely new. It guarantees absolute cheapness, rapidity and certainty, and these fill all the requirements of the public. I am not at liberty to state the nature of our contract with the American Postal Telegraph Company, except that it is an alliance that will benefit the public, and that pooling with other companies is prohibited for ten years. I expect that we shall be in operation within six months."

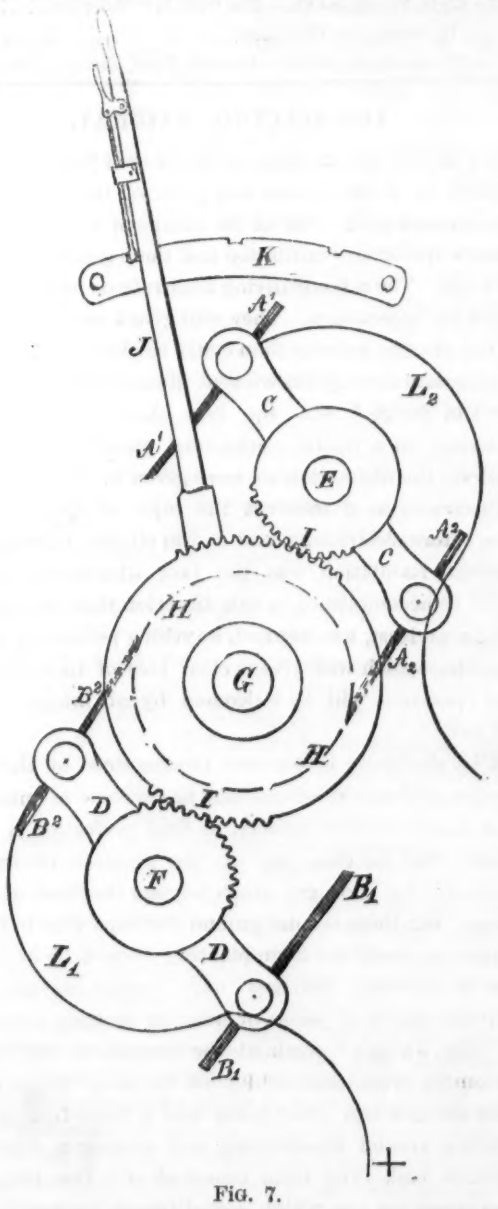

FIG. 7.

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THE ELECTRIC RAILWAY.

The article on the Electric Railway at the Chicago Exposition in to-day's issue will prove of interest to electricians everywhere. One of the editors of THE ELECTRICAL WORLD visited the exhibition and there gathered the facts set forth. The accompanying illustrations were all made under his supervision. They will give a more correct idea of the electric railway than could be obtained from pages of elaborate description without illustrations.

"The Judge" was the first electric locomotive in America, on a public commercial electric railway, and deserves the distinction we have given it.

Electricity as a motor is the topic of special interest now before electricians, and as the electric railway at the Chicago Exhibition was the best illustration of what could be accomplished in this direction that the American public, at least, has yet had, anything pertaining to it, or anything which will give a clear idea of its construction and operation, will be welcomed by all interested in the subject.

That electricity is to be the tireless steed of the future, no one doubts. When an idea has become as much of a fact as the electric railway, its final perfection is near at hand. So far this, one of the greatest electrical inventions, has not got much beyond the limit of experiment; but there is solid ground for hope that in the near future we shall see it supplanting horse-flesh and steam; see it drawing carriages over mountains and rivers, without clatter of hoofs or noise or snorting engines.

"The Judge's" work at the exposition will compare favorably with that of any of its steam rivals running over the country. The track was a three-feet gauge extending around the building, and making a sharp curve at each end. The train consisted of "The Judge" and one passenger car which seated twenty persons. Its first regular trip was made on the 9th of June, and its last on the 23d. During that time it made 1,588 trips, traversing 466.24 miles, and carrying 26,805 passengers. During all the time it was in operation not the slightest accident occurred.

The Striking Telegraphers.

When THE ELECTRICAL WORLD went to press last week the excitement of the strike was at its height, and there was every indication—especially as one company, the Rapid, had just given way to the demands of the Brotherhood—that the difficulty would be settled in time for *The Operator* of the 1st inst. to give the result. In this expectation we announced that if the end came before *The Operator* went to press subscribers to THE ELECTRICAL WORLD would each receive a copy of that issue of *The Operator*. As the situation was comparatively in *statu quo* at the first of the week, we did not send *The Operator*.

The days have gone by with no change of attitude on either side; and although eventful to both contestants, they have not been decisive. The telegraph companies still maintain an obstinate and invincible front, and the operators still hold the forts of the Brotherhood secure. There have been some defections from the ranks, as might have been expected, considering the immense number of men engaged in the strike throughout the country; but, on the other hand, many have joined the strikers, and altogether the operators have furnished an example of unanimity of action and unbroken determination unequaled by any other body of men. There have been no disorderly incidents to record, no weak complaints at the long delay, no childish repining and none of that baneful disease known as discouragement, which has such a disintegrating effect upon united bodies. The entire Brotherhood has been as hopeful and cheerful as a child who has been promised a toy. The operators all say they know the facts of the case too well to be alarmed at the Western Union's boast that it is doing very well. They were kept busy when all were on duty, and know that less than half the number of incompetents that now fill their places are not likely to be able to carry on the work to the satisfaction of either the company or the public.

They have discontinued their public meetings in this city; but still hold committee meetings and keep advised of all events which are likely to influence their cause.

Complaints have been made by the Western Union that their wires are being cut. This rumor, the operators assert, is being circulated to turn the tide of public sympathy against them. Some even declare it to be their belief that the company is cutting its own wires in order to have an excuse for its delays in the transmission of dispatches.

When the strikers who had returned to work in the offices of the American Rapid Company were paid off on Tuesday they were not paid for any services since their return after the strike, and as the terms of the compromise have not been made public, the men do not yet know whether an increase depends upon the final outcome of the strike or whether the new rates are to be paid only from August 1. Commercial circles are still annoyed at the inaccuracy and tardiness of dispatches, and the proposition of a government telegraph system in connection with the Post-Office Department is being discussed by the press with great spirit.

There is every reason to believe that the contest cannot last much longer; and that when it does come to a crisis it will terminate in favor of the operators.

The only change in the condition of the strike is that the temper of the Western Union officials is getting a little sourer. As it is a fact beyond dispute that in a controversy of any kind, victory smiles upon the contestant who keeps his temper, the operators can afford to be sanguine. The Western Union is the first of the two antagonists to have one of its representatives sentenced to jail. Manager Hall, of Galveston, Texas, was so incensed because he did not succeed in getting a member of the Brotherhood accused of striking a "contumist" convicted, that he made disrespectful remarks in the presence of the court. For the same he was fined $25 and sentenced to jail for twenty-four hours, but was subsequently released through the efforts of his counsel.

On Wednesday, President Herrick, of the Produce Exchange, in this city, appointed the following special committee of seven to inquire into the expediency of building a commercial telegraph line, to be owned and operated by the business exchanges of the principal cities: Theodore Perry, S. Jacoby, Alexander E. Orr, E. K. Livermore, S. Carll, W. A. Cole and H. T. Kneeland.

The sub-committee of the United States' Senate Committee on Education and Labor will begin its investigation of the strike on Monday next in the Post-office building in this city. Its members are: Senator Blair, of New Hampshire, chairman; Senator Pugh, of Alabama; Senator George, of Mississippi; Senator Call, of Florida, and Senator Aldrich, of Rhode Island. Representatives from both the telegraph companies and the strikers will be invited to attend and contribute to the investigation, and the sessions will be open to the press and the public.

On Wednesday the Brotherhood of this city met in Clarendon Hall and expended $2,500 in payments to strikers. No regular sum was fixed for members; but it was announced that each one would be paid as much as he or she actually needed. The amounts applied for and given ranged from $5 to $40, but the average was $7 for single men and $10 for married men. Many operators refused to accept any money from the finance committee, declaring they could get along comfortably for months. The committee will be prepared to supply needy members every day until the strike ends.

The situation to-day remains practically unchanged, with the prospects for the operators better than on the first day of the strike. The supply of available operators is thoroughly exhausted, and every man or woman in America who can handle a key well enough to send a message is either employed by the various companies or on strike. The lines being thus tightly drawn, the contest is purely one of endurance, and it is morally certain that if the same lines be maintained the Western Union will, within the next two weeks, either make some honorable compromise with its men or close its doors to the public, thus forfeiting its charter and its privileges.

The desertions from one side to the other have been remarkably few and inconsequential, while all the methods used by Western Union officials to make a break in the strikers' lines have fallen of their own weight. Promises of treble pay have been as unsuccessful as stealthy visits to young men's sisters, wives and aged parents. Indeed, the tide has set in the other direction, and at Norwich, Conn., on the 26th ult., the entire W. U. force struck, leaving only the manager. Isolated cases of "strike" at offices where there is only one man are of daily occurrence.

Since our last issue the B. & O. has made another effort to compromise. At Washington, on the 28th ult., that company, through its agent there, submitted to its operators, individually, a proposition to increase their salaries, if they would return to work at once, in the following ratio: To those receiving $40 and $50 each per month, an increase of $25 per month; those receiving $60 and above per month, an increase of $15 per month. No guarantee, however, was offered that these prices would continue, and the situation remains unchanged.

The American Rapid is doing a large business, to such points as it can reach, while the various Exchanges throughout the country are denouncing the strike and those responsible for it in unmeasured terms. For shame's sake the Western Union has taken down its "Subject to delay" signs—the standing confession of its weakness—but the complaints of delays and mutilating of business increase instead of diminish.

Meanwhile the striking operators everywhere seem quite content with the situation. Money, in sums of $100 and over, is coming in from all directions, in addition to which they are realizing large amounts from theatrical performances, excursions and base-ball matches. On the 28th ult. a concert for the benefit of the strikers, given at Ford's Opera-house, Baltimore, realized $1,300. On the 30th ult., a performance of "The Long Strike," at San Francisco, for the same object, netted $3,000. A base-ball game between New York and Philadelphia strikers, at Philadelphia, on the 30th ult., yielded over $1,800. On the same day, at Washington, D. C., $500 was realized by a base-ball match, and $500 by a steamboat excursion on the Potomac.

Subscriptions for the new Merchants and Telegraphists' Association are coming in lively, and the scheme seems to be an assured success.

The striking inspectors and linemen of the Bell Telephone Company, at Philadelphia, who went out on the 27th ult., are still firm, though the company professes to be working very well without them.

Jay Gould on Fools.

Last week Mr. Jay Gould was reported by the newspapers in this city and the Associated Press as saying that "they (the striking operators) are a set of fools." This Corinthian, the quick-witted little son of that sturdy old pioneer, John Gould, has a good many more friends than perhaps he is aware of, for his is one of those independent spirits which follow no man's lead; his character lies on the surface, and whatever he is, he is *that* to the core—you cannot mistake Jay Gould. It is related of this "splendid heathen" that, years ago, when his wealth was no more than a dream, he wrote in a young lady's album as follows: "Some men think they ought not to show themselves so weak as to be moved by any of the finer feelings that actuate the human bosom, lest its congenial and captivating influences should pervert them * * * their seared consciences are deadened to all the finer feelings, and insensible to happy influences of friendship. To them Virtue is but an echo, and Moral Worth an apology." There are poetry and lofty sentiments in these words; but what magic has since transformed an intellectual giant into a pigmy, that he must turn to call his honest operators "fools," while the crowd of flatterers about him—the very men to whom "virtue is but an echo, and moral worth an apology"—indulge in vulgar guffaws at the wit comprised in calling good men "fools."

Mr. Gould, if his youthful sentiments have not changed, knows that devotion and fidelity cannot be laughed at, and that courage and outspoken manliness, even in a poor cause, are admirable qualities which have been idolized through all time by lady fair and belted knight. It is as natural to admire these qualities as it is to despise cowardice, indecision and that peculiar sixth sense by which "thrift follows fawning." The striplings who are now contending for what they honestly believe to be right, are fighting honorably like true Americans, standing as firm as adamant—they are not fools, but young men whose

sympathies and devotion flow on unchanged and unchangeable through "life, death and that vast forever."

Admitting temporarily, for argument's sake, that the operators are wrong, shall they be called fools because they made the issue in a square, manly way, and with a youthful ardor which set the hearts of the country on fire? They are struggling with the perplexing question of capital and labor—the greatest problem in the world's history, but they have approached the subject in a spirit of fairness, without thought of violence, with phenomenal forbearance toward a certain class who ought from a sentimental point of view to be scarified—the perjured backsliders who led them on and then deserted them—and with an almost idolatrous regard for vested rights and the identity of interests between employer and employé. Is it for this that Mr. Gould calls them fools?

If Mr. Gould is fishing for fools he need not cast his lines among the present body of striking operators—gentlemen as correct in demeanor as they are in principle. Let him look among the "managers" about him, the weak-minded beings who lug military titles into their every-day civilian life—though this is certainly the most harmless of foolish foibles. Let him run his memory back through this most unfortunate affair, and observe the conduct of the opposing parties—his officials rude, haughty, unreasoning and sometimes downright idiotic, while the operators have been uniformly courteous, humble, cool and conciliatory. Let him look for fools—if he must see them—among the hat-touching, cringing crowd that surrounds him; those who have brought the Western Union—poor thing—into public ridicule, and now threaten its ruin; those who, when the strike was threatened, told him "this thing will blow over in a few days;" those who often sought to put him asleep with their soft lullaby songs while they run the machine, and those who have now so nearly run it into the ground.

Mr. Gould has nearly always been a winner, for he has chosen reliable men to work around him, but in this case it is evident that he has not succeeded in infusing his own spirit into his telegraph assistants—truly, to them, "virtue is but an echo and moral worth an apology."

IN this issue we commence a new and valuable feature, a brief mention of the claims of the more important patents for electrical inventions, as they are issued, with diagrammatic illustrations where they are necessary. The simple mention that a patent has been granted somebody for an improved telephone or other device does not carry much information with it. Hereafter we will keep our readers informed as to the novel features of important electrical inventions and what the claims are.

WE should perhaps apologize to such of our readers as are not telegraphers for the unusual amount of space taken up recently in THE ELECTRICAL WORLD with accounts of the telegraphers' strike. But, of all the branches of electricity, none is more important or widespread than the telegraph, and we have devoted the space to the present troubles both from sympathy with the operators in their just cause and from a desire to record the great strike as a matter of professional and contemporaneous history.

SINCE the strike commenced there has been a marked falling off in the aggregate of speculative dealings in grain, provisions, cotton and other products, the delay and uncertainty in the transmission of orders and reports by wire nearly paralyzing the speculators. The current of legitimate trade, however, which always runs sluggishly between seasons, has not suffered seriously and the grand army of "contumists" can, by working night and day, keep within sight of the business during the vacation season of the merchant and broker. But with the middle of August and the great increase in the volume of general business consequent upon the opening of the fall trade, the American Rapid would have plenty of business if it could duplicate its present system of lines and extend them as far again, while the Western Union would fall hopelessly in the rear. The boys went out to stick this time, and stick they seem determined to do.

The Analysis of Ohm's Law.

The widespread interest which electricity is awakening under the stimulating influence of its present activity of development in individual enterprise is the cause of a general desire for more definite and comprehensive knowledge of its properties. More attention is now turned than ever to the analysis of the various phenomena of electrical action in the endeavor to obtain a good conception of them and a logical understanding of the fundamental principles upon which they depend. Ohm's law appears to be the favorite topic of study, and this is not surprising, for that valuable law is indeed the very key-note of success in all electrical applications.

It is of inestimable utility to all who have to deal with electricity, whether as electricians or as observers, for in many cases it is our only means of defining the results arising from certain causes, or of determining the conditions to success. A thorough knowledge of this law and its bearings is, therefore, indispensable to all who seek to enter this field, or who, having entered it, desire to excel in it.

The student is apt to encounter many difficulties at first in his attempt to form a conception of such abstract ideas as potential, electromotive force, current and resistance, which are the premises on which Ohm's law reasons so beautifully. It is unfortunately the case, moreover, that nearly all the text-books on the principles of electricity fail to give clear notions on the subject and oftentimes leave the mind confused rather than enlightened. We find in a current issue of our English contemporary, *The Electrician*, of London, an interesting and valuable article on "Potential Current and Resistance," from the pen of a well-known electrician, Mr. John T. Sprague, a valuable contribution to the analysis of Ohm's law. This author possesses the enviable faculty of making his expositions of electrical phenomena and principles clear and intelligible, and he often suggests new and valuable thoughts by his original way of handling his subject. His present theme is of such universal interest, and there is so much benefit to be derived from following Mr. Sprague's reasoning, that we reproduce this article for our readers.

In previous papers the author has endeavored to show an analogy between electric currents and water currents, and the present paper is an attempt to carry out this analogy further and to embody some new points of interest lately developed by him. The author states that since force is the origin of action, conduction its channel and current the result, that order of consideration might appear reasonable, but these divisions cannot be wholly maintained, and the various subjects will be discussed as they come.

1. Current is most easily conceived because it deals with actual tangible facts in nature, while the others are matters of calculation. Current in electricity, as with water, means the rate of passages of unit quantity across any section of the conductor; its most definite evidence and measure is the chemical action produced by the passage of electricity through liquids. Unfortunately, the accepted unit of electric quantity, the coulomb, does not accord definitely with the natural unit

$$\frac{\text{Atomic weight}}{\text{Valency}} = \text{electric equivalent},$$

which would make one of hydrogen represent the unit of electric quantity, and, with the element of time, the unit of current; but though only a fractional value represents the relation, and it is not even settled whether the real value of the coulomb and ampère is .00001022 or .000010415 of a gramme, still this is the true physical representation of electric quantity, which corresponds to "mass" in mechanical calculations.

2. In the older works on elecricity "quantity" currents and "intensity" currents were spoken of, and even now we occasionally meet with such an unmeaning phrase as the "tension" of a current. All such ideas, which give the impression of some difference of nature in currents, are misleading. Current as such, has only one quality, its rate; a given current, that is one which will produce a certain deflection in a particular galvanometer, or will deposit a certain weight of metal from a solution, is exactly the same in its nature and properties whether it comes from a large or small cell, from a single cell, or from a thousand cells in series. But the same current may have different effects according to its *density*; that is according to its ratio to the sectional area of the conductor, or its quantity per unit of area. This influences the temperature generated in wires, and is of supreme importance in electrolysis, so that it is unfortunate that some writers have taken to using the already misapplied term "intensity of current" for this ratio.

3. OHM'S LAWS.—These laws or formulæ are universally employed by electricians, but are not confined to electricity, as they express the common fundamental mechanical laws. The relations established by Ohm's laws between electromotive force, resistance and the current and its work, are simply the well-known laws of mechanics or the relations between force, such as gravity, weight and velocity; and the laws themselves are merely mathematical expressions. Invaluable in dealing with the modes of operation, they only delude us if we regard them as facts, and do not clearly trace out the reasons why they are valuable. Mr. Oliver Heaviside has made some remarks on this subject, in which this matter seems to be curiously undervalued, when, after referring to the confusion in some minds as to electric resistance, he remarks that "R is just called so," and again, "if ideas are correct it is of secondary importance what language is used to express them." But that is just the point: a writer's idea may be correct, but when he has to use words which have already an entirely different meaning, it is by no means sure that his readers' ideas will be correct. It is in fact only quite lately, and in no degree consequent upon the teachings of the professional teachers of electricity and their formulæ that people are beginning to understand that R, the electric *resistance*, is not resistance at all as commonly understood. When he suggests that the fact that this so-called resistance presents no more obstacle to a large current than to a small one (p. 199) is a powerful argument in favor of providential design, one is apt not only to smile at his suggestions of a soporific, but to doubt whether he has himself fully realized that the fact itself results merely from an arithmetical artifice explained in my earlier papers referred to, and which I shall recur to in due course.

Multitudes of students are misled by this misuse of the word resistance, and eminent electricians and engineers have been equally deluded. Mr. Siemens said in a public lecture: "My critics have, however, fallen into the error of overlooking the fact that half a unit resistance is the same for a circuit capable of working one lamp as it is for working 100 or 1,000 lamps. *Electricity is not conducted upon the conditions appertaining to a pipe conveying a ponderable fluid*, the resistance of which increases with a square of the velocity of flow." Sir W. Armstrong, in his address to the mechanical section of the British Association in 1881, says: "In the case of a fluid current through a pipe the resistance to the flow increases as the square of the velocity, while in the case of an electric current the resistance through a given conductor is a constant proportion of the energy transmitted. So far, therefore, as resistance is concerned, electricity has a great advantage over water for the transmission of power." So we may see that by converting mathematical formulæ, which are nothing but mental tools (apparatus for mechanical thinking in some sense), into actual facts and theories, electricians have actually been led into great errors as to the nature of the electric constants.

In these quotations we have two distinct statements—1st, that in electricity a resistance is the same to all currents transmitted; 2d, the sentence italicized, that currents of electricity and currents of water depend on different laws. Most electricians then, and many of them now, would indorse those statements. I dealt with them at the time in the pages of *The Electrician* and the *English Mechanic*, and will now show clearly what is really the thing that is alike for large and small currents, and also that *water in pipes and electricity in wires are conducted upon identical conditions.* 4. The fundamental expression of

Ohm's laws is $\frac{E}{R} = C$, which means force (or more correctly "potential") divided by resistance defines the current, or rate of flow.

It follows that any two of the three elements, E, R and C, being known, we can calculate the third thus, using the units or the *B. A.* system; the volt for E. M. F., the ohm for resistance R and ampère for current C.

Current.—$E \div R = C$. Force and resistance being known.

Electromotive Force.—$C \times R = E$. Current and resistance being known.

Resistance.—$E \div C = R$.

Energy$= C^2$, the square of current in unit, or unaltered conductor, or $C^2 \times R$ as a general law.

5. The usual expression of the meaning of the formula is, *current* is *as the force* and *inversely as the resistance.* In order to fix the mind upon the ideas I wish to develop, I give this modified definition: *Current* is *as the E.M.F.* (which is *potential*), and *as the conducting capacity.* That which in the usual expression *is called resistance*, is simply the *reciprocal of the conducting capacity.* It has nothing to do with anything commonly known as resistance.

6. According to these relations, C varies as E, but energy, as work or heat, *which are the true resistance*, varies as E^2, that is as the square of either C the current, or E the E. M. F., in unit or any unaltered conductor, and it also varies as the so-called resistance; that is to say, it is inversely as the conducting capacity of circuits. This is precisely the ordinary law of mechanics, say in friction, where work absorbed is as the square of velocity, and directly as some other element, such as weight.

7. The very first point as to which a clear understanding is necessary is whether these symbols E, R and C have any realities behind them. Do they represent facts, and if so, what facts? Or are they merely mathematical expressions, simple tools of thought? If the latter, we must carefully avoid the error of mistaking them for facts, lest, like the monster Frankenstein, they prove too much for their creators. It will be more convenient to examine this while studying Ohm's formula as a whole, than to treat each head singly.

8. *Electromotive Force.*—Is the E. M. F., which we symbolize by E, *a force?* Let us see what idea we can form of it. A force tending to set electricity in motion; or, to use a better phrase, to set up that motion which we call electricity. Here it will be seen we have two considerations presented to us: an effect, the motion produced; a cause, the force producing the motion. Of these the first, the motion, is of necessity an actual fact, though we may hold different ideas as to what is the thing. But does the *cause*—the *force*—exist, that is to say, the special force? There are actual forces having real existence, such as the various attractions, of which we may take gravitation as the type; these are, so to speak, self-existent—we know not their causes. But there are other agencies which we call forces, yet which have no actual existence. They are really transformations of energy, and are forces only in the mathematical sense.

9. *Development of E. M. F.*—When we dissolve zinc in a battery this force makes its appearance. It is said by some to be due to the contact of the two dissimilar metals. But one thing is certain, this force can do no work unless it is maintained by an equivalent supply of energy, and, as a matter of fact easily proved, the degree of electromotive force produced is measurable in terms of the energy transformed in its generation, which is measurable by the heat set free in the chemical combination.

But if we expose the junctions of two different metals to heat, we find electromotive force set up in degrees de-

pending (1) upon some inherent property of the metals, and (2) upon the difference of temperature produced, which means, in fact, the quantity of energy which can be thrown into the circuit.

Similar results are found when we examine the E. M. F. set up by dynamo machines. It bears a definite relation to the energy expended. We find also that though electromotive force is constantly acting upon the circuit it has no accelerating action. We therefore conclude that it has no actual existence, but is due to conversion of energy, and that it must in some way be equivalent to the energy which it expresses.

The effect of the ideas about to be presented is to show that E. M. F. is no occult effect of *contact*, or of cutting lines of force, etc; that these are but "conditions;" that E. M. F. (or potential) is always an expression for a measure of the effort of energy (potential or kinetic) to take the kinetic form under any particular conditions.

10. *Any agency may be called a force* which is capable of setting up motion, or altering the conditions of motion in a mass of matter. Thus if we take a ball of lead and let it fall, motion is imparted to it by gravitation. We may push the same ball of lead along a table, or by muscular energy hurl it to a distance. We may strike it, as a cricket ball is put in motion, by a percussive blow; or we may, by aid of a gun, set in motion by means of compressed air, or by the explosion of gunpowder. In all these cases motion is produced, and we may call the agency in each case a "force."

11. *Mechanico-Motive Force.*—We may embody all these in one expression, and say they are due to a "mechanico-motive force," the intensity of which can be measured by its capacity to produce momentum. Of course the object of this term is to obtain an exact mechanical counterpart to the electric expression, but this term, or something like it, has actually been employed in mechanics. We have then to see whether this mechanical analogue is a force, or what is its true meaning.

12. *Static and Dynamic Force.*—There are two ways of treating and measuring a "force." (1) By the *pressure* it produces. This is a static action, and it measures a force as a *degree*, not as a quantity. A force so regarded is an abstract property or power; it has no relation to energy, because it does no work, though it has a relation to *potential energy*, as will be seen later. (2) By the motion it produces in matter, and this, again, has two aspects. 1. *Velocity*, which may be general or abstract, as in the case of the force of gravitation, when expressed by the ordinary symbol g, meaning its capacity of generating a velocity of 32.2 ft. per second. 2. *Momentum*, in which the force becomes concrete and *quantitative* by the introduction of unit mass of matter, and unit time. But this is no longer true *force*, it is an expression of *energy*—of the work a force can do under unit conditions. The *dyne* is such a force, or, more truly, a mathematical expression for a unit quantity of force, and it is the same value, in reality, as the *erg*, the unit of energy. They are simple expressions for the two aspects, *cause* and *effect*, force and work, which of necessity are equal. This will, of course, be objected to by the mathematical minded; but this is a case where truly, "if the ideas are correct, it is of secondary importance what language is used to express them." The idea is an inevitable consequence of the conservation of energy. *Force expended and work done must be equal*, and the purpose of my statement as to their units, the dyne and erg, is just to impress that fact. The usual plan of regarding them as belonging to distinct orders is directed to another purpose—their practical application.

13. *Gravitation* as a natural force therefore produces (1) a static pressure, (2) a velocity (say 32 feet per second), (3) a momentum in a mass (say 16 feet lbs. per second). It also produces *acceleration*, that is to say, acting continuously its effect is accumulative. This property would be important in a treatise on mechanics, but does not necessarily enter into the electric treatment of force; its effects are included in the actual velocity and momentum generated. But it may be well to point out that the ordinary conception of gravitation, as due to the attraction of the earth for movable bodies, is misleading, because it leaves out of sight the part played by the second body itself. The effect of this is that while we can express a spring or steam force as a pressure of so many pounds per square inch, we cannot so express gravitation *per se*. We shall deal with such a pressure presently as "head of water," but this is a compound expression. Besides the attraction of the earth, it includes that of the water itself, that is, its own weight (or more properly mass). Of course it is perfectly known that this attraction is really that of the two masses, earth and body; it is only the common way of thinking that I refer to, which reacts even upon science. In our utter ignorance of the real cause of gravitation, we fix our ideas upon the mere masses of matter, and satisfy ourselves with the statement that it is $\frac{M \times M_1}{D^2}$, and in that formula we bury away the agency itself, the most perfect representation we can find in nature of an omnipresent consciousness.

14. We wind up a spring, and we know we have stored our work in it. We wind up a weight, and we know we have stored our work in it. We speak of "potential energy" in both cases, but in how different a matter do we think of the two agencies of storage. One seems real and the other mythical; the one we call energy of *stress*, molecular strain; the other we call energy of *position*. But let us conceive a powerful spiral spring attached to a rope passing over a pulley, and thence to a winch by which the spring can be strained, or wound up. We have here a tangible agent to deal with. We see the strained spring, and we know that the spring, by virtue of that strain, will return us our energy by doing work equivalent to that employed in generating the *molecular stress*. But we replace the spring by a mere weight, which we wind up, and then we talk of energy of position. It should be clearly realized that the two conditions are identical; in winding up the weight we have in some way, wholly unknown to us, put a stress upon the earth and stored energy just as certainly as in the spring. We do not know how, but in some way the force of gravitation is as surely an expression of energy stored up in matter as is the attraction exerted between two charged electric surfaces across the strained dielectric, which is expressed by the same formula $\frac{Q \times Q^1}{d^2}$, and by the equivalent magnetic law, all these so-called quantities being, in fact, simply measures of the stresses or attractions exerted by forces.

Erratic Electricity.

Curious freaks of lightning have been unusually numerous this summer. The "electric fluid," as the unscientific journals say, has not been content with doing the ordinary summer damage in the ordinary way. It must needs keep up with the times in devising new schemes of fright and ruin.

On Thursday evening of last week a heavy cloud passed over Newark, N. J., from which there was an extraordinary play of lightning unaccompanied by thunder. The lightning from it was so sudden and unexpected that no person had an opportunity of noticing its direction or peculiarities. In describing it one man said, "The whole atmosphere seemed to become filled with it all at once." The curious cloud visited the section which borders on the meadows near the Passaic River, which is filled with factories and the poorer class of houses.

In Newark, the block bounded by Esther and Lockwood streets and Albert avenue appeared to be encircled by a chain of fire. Six boys who were in a vacant lot were all prostrated and one was killed. His clothing was stripped from his body, his shoes were torn into fragments and his body was scorched as if by flame. A man who lives at No. 9 Esther street says that he was at a window on the second floor of his house, and while in the act of driving a nail into the outside of the window frame the hammer was struck by lightning and sent spinning over a table that stood near the window. The lightning also ignited the tobacco in his pipe, which was in his mouth, and knocked the pipe out of his mouth and on to the table. He was rendered speechless for some time, his tongue appearing to be paralyzed. The plastering was torn from the chimney in the room. A woman who lives in the same house says that when the shock came she was thrown to the floor and was unconscious for several minutes. She felt as if the top of her head was being taken off. A man who was on his way home had a shovel knocked out of his hand by the lightning. A woman who resides at 251 Market street was in the yard of her house and saw the lightning blazing all around her. She says it seemed to press her to the ground. Near the spot where the boy was killed the lightning lifted the corner of the roof of an outbuilding and shivered the boards into splinters. A woman who lived in the house belonging was in the kitchen at the time, and felt something pass through her hand and up her arm as she stood by the stove, and then fell insensible. When she revived her hand felt as if it had been burned. The cloud is described as of a blue-black color, with vertical streaks of a lurid appearance.

How it Feels to be Struck by Lightning.

Curtis B. Wells, of this city, has received a letter from Henry M. Burt, detailing the editor's experience with lightning. Mr. Burt certainly had a narrow escape. He writes:

"A little after 6 o'clock Saturday night I was in my office in the old Summit House on Mount Washington, and had just given directions to Darby about making up a form, when all at once I felt a tremendous blow in the back. I could not imagine at first what caused it, but instantly thereafter I saw a ball of fire as large as a man's head directly in front of me, not three feet off. It exploded with a tremendous noise, seemingly as loud as a cannon, and then I knew what must have happened. My left leg seemed to be completely paralyzed, and I fell to the floor. Three of my printers were in the room at the time, two sitting at the table near me and one standing up a little further off. The latter had the skin on one hand torn up, another was hit in the back, and the third escaped without injury. At first I felt as though a ball had gone through my body, and that all below had been shot away. I was startled and confounded, but did not lose consciousness. The young man who could get out of the office ran to the hotel, the Summit House, and told what had happened. Help came immediately, and I was removed to my room in the hotel and undressed. Dr. Strong, a medical student of Harvard, took my case in charge and treated me with great skill. In the course of two or three hours I could begin to move my leg a very little. This (Monday) morning I find myself quite comfortable, though I cannot walk without a cane, and my leg pains me considerably. I can assure you that it was a narrow escape from instant death, and for one I do not care to go through another experience like it. As the storms are all, or most of them, below the summit, we have very little fear of being struck by lightning. In fact, for 30 years no one has been hurt or had such a narrow escape from death. It is an old saying that lightning never strikes twice in the same place: and I am sure I do not care to have it. We were all the more surprised from the fact that until the bolt came in we had no idea of the presence of an electric storm. It had begun to rain a little, but there had been no flashes of lightning. It was as startling as it would have been to get a clap of thunder out of a clear sky. You have probably heard of the impression of a tree being found upon the bodies of those killed by lightning. The same thing was noticed upon my back, and, as there are no trees upon Mount Washington, it seems to me that the peculiar appearance must be the result of the blood sett'ing in the smaller veins."—*Hartford Courant, July* 31.

Philadelphia's Fire and Police Alarms.

Philadelphia boasts of being the only city in the country that has the police and fire-alarm telegraph combined in one system and under one management. Under this arrangement there is perfect order and discipline, the work of the two departments being practically performed at the cost of what may be called only a trifle above the expense which would otherwise be incurred for either department singly. The whole force is one superintendent, one assistant superintendent, one lineman, two battery men, one inspector and sixty operators, and most of the supplies, such as batteries, wire and instruments, are stored at police headquarters.

The old style boxes are being retired and their places supplied by boxes of an improved form. The new box consists of one outer cast-iron case, that contains an inner box, also of iron, which is accessible to the members of the fire and police force for the purpose of sending alarms of fire. Within the second box is a third case, which contains fire signal apparatus of beautiful fineness. This is thoroughly protected from dust and moisture and atmospheric influences, and can be kept clean and in good working order for half a century if not tampered with. The lock upon the outer case is what is known as the trap lock. The keys of this are given to certain officers of the police and the fire departments and are always immediately available in case of fire. But when the outer case is unlocked the key is fastened and cannot be withdrawn until released by a master key. One of these is given to each lieutenant of police and one to certain members of the fire department, and all the keys of the boxes are numbered, so that in every case of alarm the sender can be discovered without difficulty.

Another improvement being introduced into this department is the new electro-mechanical gong. They are worked direct from the Central office without the aid of local batteries, as was the case with the old style of gongs. These have been placed also in the houses of the chief and assistant engineers and in the offices of several of the street railroads.

A Secondary Battery Decision.

The patent interference case of N. S. Keith, of the American Electric Storage Company, of New York, against Charles F. Brush, of the Brush Electric Company, of Cleveland, Ohio, was decided at Washington, August 2, priority of invention being awarded to Brush. The declaration in the case contained three counts, each supposed to represent a distinct invention claimed by both, as follows: First, a secondary battery having a plate of cast-lead supporting the active coating; second, a secondary battery element consisting primarily of cast-lead; third, a method or process of making a secondary battery element, consisting in casting a suitable body, frame, or other support of lead, and placing thereon an active or absorbing coating or substance.

Electric Jewelry.

The London correspondent of the Philadelphia *Evening Telegraph* writes as follows:

I am told by a fashionable dressmaker, several of whose little bills I have, alas! recently had to pay, that there is every probability that ladies' "dress-improvers" will increase rather than decrease in size. "You see, sir," said my voluble informant, "there must be a space somewhere for the battery." "Battery!" I gasped; "what on earth do you mean?" "Why," said she, with a pitying smile at my ignorance, "the electric battery, to be sure. It is becoming more and more fashionable for ladies to wear electric jewelry, and room for it must be found in some portion of the costume." A light—electric, I suppose—dawned, or shone, upon my benighted mind, and then I recollected having seen one lady at a fancy dress ball with an electric diadem blazing in her head-gear, but the spectacle was regarded as a curious theatrical display, and no one dreamed that it was likely to become fashionable ex-

cept among "ladies of the ballet." However, it is true enough that a good few of the *demi-mondaines* are adopting this rather startling method of adorning themselves, and the custom is climbing up the social scale, for in this, as in a good many other fashions, the *monde* follows the *demi-monde*. Any color can be got out of glass, and for a tiny peep of light the smallest battery is necessary. A dashing *demi-mondaine* can thus make a pennyworth of glass eclipse a duchess' diamonds or rubies. The correct thing now is to wear a star or brooch, illuminated by electricity, upon the left shoulder, instead of the diadems at first worn at fancy balls.

Promoting the Electric Light.

Mr. Thomas A. Edison, when questioned as to whether he intended to give up inventing and experimenting for the present, said: "I have come to the conclusion that my system of lighting, having been perfected, should be promoted, and that I could take hold and push the system better than any one else. It is so complicated that I do not feel like trusting it to new and untried hands, because science and dollars are so mixed up in it. After the right to introduce the light has been bought by outside parties, I take a contract to erect buildings, open mains, etc., and after thirty days I turn the establishment over to the local company for such money as has been agreed upon. I want to put the light in six places like Utica every month from now on. I want to accomplish what I set out to do, namely, demonstrate the utility of sub-divided electric light by means of incandescent lamps, and entirely replace gas. It is proving just as I expected. It will take a year or more yet to complete the work of perfecting the entire system. After that is done I shall resume inventing, but just what I shall invent I am unable to say. It will be in the same line of business I am pursuing. I have heretofore found a lot of things I dare not touch. In experimenting I find a good many things I never looked for."

The Risks of Telegraphing.

To the Editor of The World:

I notice that Brother F. B. McGuire, of the Central Labor Union, was introduced by the Chairman of the telegraphers' meeting to the assembled operators.

According to the report of Brother McGuire's remarks, as published in Tuesday's *Post*, he informed the telegraphers that "the work of an operator involved a great deal of risk, for the passage of the electric current through the body for any length of time would completely shatter any but the strongest constitutions."

I hasten to inform Brother McGuire that if the telegraph companies were ever addicted to the cruel practice alluded to by him, they have generally abandoned it.

And the old companies are now passing the electric current through the wires, instead of putting it through the bodies of the poor operators.

Possibly Brother McGuire may have got the telegraph tangled up with things more familiar. He may have confounded what is termed "Jersey litenin" with the electric currents now generally used for telegraphic purposes.

"Jersey litenin" is no doubt an active fluid, and if passed through the body of an operator "for any length of time," would, as Brother McGuire says, be likely to shatter his constitution; but that particular fluid is not used for battery purposes by any of the telegraph companies.

By all means let Brother McGuire make another speech. He is an interesting speaker. AN OLD OPERATOR.

NEW YORK, July 27.

THE TELEGRAPH.

A LOAN TO A TELEGRAPH COMPANY.—On Wednesday the Bankers and Merchants' Telegraph Company secured a loan from the Farmers' Loan and Trust Company of $300,000, for which it has issued 300 bonds of the denomination of $1,000 each.

THE POSTAL TELEGRAPH.—The directors of the Postal Telegraph have ordered the payment of the first coupon on the $3,000,000 outstanding bonds of the company for the interest due for the six months ending Aug. 1. Mr. H. L. Horton, of New York, has been elected treasurer, in place of Mr. John B. Alley, of Boston, resigned. The company announces that its New York and Chicago offices will be open early next week.

THE EXCHANGE TELEGRAPH COMPANY.—A certificate incorporating the Exchange Telegraph Company was filed on the 1st inst. in the County Clerk's office, in this city. The lines of the company are to run from this city to San Francisco, Cal., touching at all intermediate points which may be desired. The capital stock is fixed at $2,000,000, divided into 2,000 shares of $100 each, and provision is also made for the increase of the capital stock in case it becomes necessary. The incorporators are Stephen D. Field, Charles S. Hurd, Alexander Thain, J. Bentley Squire and James C. Jewett.

THE PRESIDENT ON RECORD IN FAVOR OF THE STRIKERS.—A despatch from Washington says that President Arthur put himself on record on Saturday last in favor of the telegraph strike. When he drove to the executive mansion from the Soldiers' Home, preparatory to going away, he asked the telegraph operators at the White House if they were strikers. He was informed that they were satisfied with the salaries they were receiving. The President answered that he was glad of it, and, if they were not, he would raise their salaries to the amount asked for, so as to officially recognize the fact that he favored proper wages for all skilled labor.

THE POSTAL TELEGRAPH'S DELAY.—Every day for more than a month past it has been announced that the Postal Telegraph Company would open its lines to the public within a week, and still the opening languishes. The underground conduit at Chicago, supposed to be the cause of delay, has at last been completed; but now another obstacle in the shape of a "serious disagreement among the new board of directors" has arisen. At a full meeting of the directors on Tuesday, Mr. Hugh J. Jewett, who is also a director of the Western Union, suggested that the rates fixed at a previous meeting, at which he was not present, were much too low. He urged that they should be advanced. In this position he was supported, it is understood, by Thomas Dickson, who became a member of the Board at his solicitation, and by President Erhardt. This was not received favorably by the other directors, who believed that the company could do a profitable business at the rate of 25 cents for twenty words. Some of the directors expressed surprise that Mr. Jewett should advocate higher rates. They did not hesitate, it is said, to put their suspicions into plain and forcible language. No change in the proposed tariff was made. Vice-President Cummins, however, denies that there was any misunderstanding at the meeting, and says the question was not even touched. He adds that the officers expect that the lines will be opened to the public to-day (Saturday).

THE DAY EDISON'S FORTUNE WAS MADE.—A telegraph operator in Vicksburg, Miss., said: "Yes, Edison used to work the other end of a circuit with me, and I knew him when he was in Memphis some thirteen or fourteen years ago. He always looked ratty and never spent his money on clothes, but the reason was that he was always tinkering with some new contrivance or other, and spent his money in paying for material to work out his inventions. He used to take press in Memphis. He was as fast as they make 'em and his copy never gave a telegraph editor a bit of trouble. He had a way while waiting for copy of drawing caricatures, illustrating the characters of news he was getting, and putting them along in the spaces of the copy he sent into the press. This made one of the papers up there, I forget which, red hot, and it opened on him and had a good deal to do with his being fired by the manager. Edison didn't want the fool editor to print his funny pictures in his telegraphic news. He only drew them for his own amusement. When he went to Boston with his yellow linen breeches on in the middle of winter, the manager of the office, finding he was an expert, hired him to keep the repeaters in order. Edison worked at the instruments a part of two days, and then was caught by the manager of the office fooling with some new contrivance of his own. 'Thought I hired you to keep those repeaters in order,' said the manager. 'You did,' said Edison, 'but I've put a kink or two into them that will make them keep themselves in order.' From that day his fortune was made."

THE TELEPHONE.

A TELEPHONIST'S GIFT TO THE OPERATORS.—Mr. Loren N. Downes, gave the striking operators $1,000. Mr. Downes is an ex-operator.

A NEW TELEPHONE LINE.—Telephonic communication between Baltimore and Washington was formally opened on the 25th ult. by the line of the Chesapeake & Potomac Telephone Company.

THE NEW ENGLAND CONSOLIDATION.—A telegram, dated Lowell, August 1, says that the basis of the consolidation of the New England telephone companies has virtually been agreed upon. The American Bell Company, holding one-half of the stock, $8,000,000, the balance of the $16,000,000 will represent the property, except $1,000,000 held in the treasury for construction. It is believed that the business will be completed by August 15.

THE TELEPHONE IN MEXICO.—The telephone system of Oaxaca has been established under the most favorable auspices. The central office is fitted up in most elegant style and has the latest modern improvements common to large cities. The service, so says the official paper of the State of Oaxaca, is efficient, and the employés are on the alert to repair any "interruption" that may occur. The system is under the management of Mr. A. G. Haines. —*Two Republics, City of Mexico.*

THE DRAWBAUGH PATENT.—Herbert Valentine, one of the corporators of the Drawbaugh Telephone and Telegraph Company, said recently that nothing beyond the filing of the certificate of incorporation had been done. The company would use the Drawbaugh patent, which had been sustained, he said, by a recent decision of the Patent Office. The corporators represented certain persons whose names could not now be made public, but who had large capital and influence. An officer of one of the telegraph companies said that this was the third company that had been formed to operate the Drawbaugh patent.

THE TELEPHONE COMPANY'S NORTHWESTERN AND SOUTHWESTERN TERRITORY.—When the Lowell management bought the northwestern franchise, there were three lines between Minneapolis and St. Paul. There are to-day 13, and five additional wires in process of erection. At Minneapolis, where a new system has been under construction for a few weeks, 102 orders for telephones had accumulated July 16, when everything was in readiness to resume business. The Erie Company has just acquired, by purchase at auction from the government, 500 miles of telegraph wire and poles, connecting towns in western Texas, at not over 25 per cent. of the first cost. Necessary repairs will be made and the wire converted to immediate use. The Erie's July output promises to be nearly 600 instruments. Manager L. N. Downs started for Cleveland last week to make certain economic changes in the management of affairs there.

THE BELL CONTEST.—Antoine Meuces, of Clifton, S. I., writes the following communication to the *Star* of this city: In order to substantiate Mr. Bell's priority in the invention of the telephone under the date of March, 1876, which it is so lengthily sustained in the communication of the 21st, to all of the leading papers, the Examiner at the Patent Office, Washington, ought to be able to annihilate, with substantial facts and demonstrations, the three caveats which he, his predecessor or the Commissioner of Patents granted to me in the years 1871, 1872, 1873, through the Patent Solicitor, Thomas D. Stetson, for my application of same invention, and which three copies are always in my possession, open to public inspection. When such evidence shall be brought forth and made public, I shall not hesitate to yield the priority of invention to Mr. Bell or any one else who might be entitled to it, but until then I shall not abandon my rights, and shall call myself, by valid documents, the first American citizen who has obtained, from said Patent Office at Washington, a caveat which entitles me to the priority of invention of the great contended telephone.

TELEPHONE CAPITAL.—The Boston *Transcript* continues to be savage on the telephone companies, but shows both ignorance and animosity which are unwarrantable. It compares the telephone business with telegraph business —things which are not fairly comparable, as to capitalization certainly. If every man who sends telegraphic dispatches had to have a battery and instrument, and if a large proportion of them had also to be furnished with a private wire, the amount of capital now in telegraphs, large and diluted as it is, would be a mere drop in the bucket. The *Transcript* also divides the whole telephone capital by the number of subscribers, and calls the quotient the capitalization of each subscriber. But this utterly ignores the immense and growing trunk line business, whose capitalization is not properly divisible among subscribers. Besides, in the infancy of the business, when each company has fewer subscribers than it will have in the near future, the amount of capital to each is necessarily larger than it will soon be. The capital stock of the *Transcript* itself is watered far more in proportion than the stock of any telephone company in the world, if we make the same use of figures that it does in speaking of telephones—*i. e.*, if we reckon every addition on the original plant as so much water. But the telephone business has already outgrown such attacks.—*Lowell Courier.*

TWO NEW TELEPHONE COMPANIES.—The Drawbaugh Telephone and Telegraph Company, organized for the purpose of buying, constructing, owning and maintaining lines of electric telegraph, was incorporated on the 25th ult. The general routes of the line are to be from New York to Albany and Buffalo; also from New York to any or all cities and villages in this State. The privilege is reserved to extend the lines across other States and Territories in the United States and the other countries comprising the Western Hemisphere. The capital is $15,000,000, divided into 350,000 shares of $50 each. The capital may hereafter be increased to $50,000,000. The shareholders are William Enos Walkley, Brooklyn, 75,000 shares; Charles Duryea Beach, Brooklyn, 149,000: Albert Palmer Fisher, New York, 75,000; and Herbert Valentine, New York, 1,000. The duration of the company is to be fifty years. A certificate of incorporation was also issued to the Oaxaca Telegraph and Telephone Company of Mexico, capital $50,000, with the proviso that it may be increased to $100,000. The capital is divided into 5,000 shares, which are held by Charles D. Haines and F. H. Skeele, of Brooklyn, each 2,000, and Samuel H. Sterns, of New York, 1,000 shares. The general route is from New York city across New Jersey, and thence extending southward through the United States and Mexico to the States of Oaxaca, Guerrero, Michoacan, Tabasco, and Yucatan, and such other places as may be designated. The continuance of the company shall be 100 years.

BALTIMORE AND WASHINGTON UNITED BY TELEPHONE.—The telephone communication just established between Baltimore and Washington was given a public test on July 24 in the office of Davis & Proal, Chamber of Commerce, Baltimore. Several members of the press were present and took part in the trial. Connection was made through the Baltimore exchange. Conversation was carried on principally between Mr. A. Wilson, Jr., in Baltimore, and an Associated Press reporter in Washington, and the words could be quite distinctly understood, despite a slight disturbance of the wires, caused by the electrical current of an approaching thunderstorm.

In Washington a number of gentlemen visited the telephone office in the top story of the building No. 1,420 New York avenue, and carried on conversations with persons in the telephone office in Baltimore. The National Capital Telephone Company has been absorbed in a new company known as the Chesapeake & Potomac Company, which embraces all the territory in the State of Maryland and the District of Columbia. The Baltimore Company has been absorbed also in the new concern. Though Baltimore is the larger city, the headquarters of the new company are at Washington. The company has erected two lines of poles between Washington and Baltimore, and is about to erect a third. These poles will have capacity each for six wires, which will accommodate a great volume of business. The new lines of wire to be laid will be of postal telephone wire—a copper wire with a steel core —which, it is said, has proved to be the best wire for telephone service over long distances.

Exchanges have been established at Hagerstown, Frederick and Cumberland, Md., and after these points have been connected with each other, lines will then be extended to Baltimore. Wires will be erected connecting the latter city with New York, Philadelphia and other prominent points.

THE ELECTRIC LIGHT.

RIVAL OFFERS.—The Edison Electric Light Company is offering to light parishes in London at $2.25 for the equivalent of 1,000 feet of gas, and an English company, telegraph construction and maintenance, is offering to do the same thing at $1,25.

AN INJUNCTION AGAINST POLES.—In the Superior Court, Special Term, on the 24th ult., Judge Ingraham granted an injunction restraining the United States Illuminating Company from erecting poles for the purpose of electric lighting in front of the premises of Tiffany & Co., of this city.

ELECTRIC LIGHT FOR THE HARLEM BRIDGE.—At the semi-monthly meeting of the Park Commissioners of this city, held on Wednesday, it was decided to have electric lights on the Madison avenue bridge, provided the engine which was used on the draw could furnish the generating power. The treasurer of the board was requested to ascertain the price of a dynamo machine to light the Third avenue bridge.

EDISON ELECTRIC LIGHT CONTRACTS.—Mr. Edison says that among the contracts signed for fitting out small and large towns with the Edison electric light are Sunbury, Pa., where the company is putting in 500 lights; Shamokin, Pa., 1,600 lights; Brockton, Mass., 1,600 lights; Lowell, Mass, 1,200 lights; Lawrence, Mass, 4,000 lights; Haverhill, Mass., 1,600 lights; Renovo, Pa., 500 lights; Erie, Pa., 1,600 lights; Hamilton, O., 1,600 lights; St. Louis, Mo., 9,600 lights; Minneapolis and St. Paul, Minn., 6,400 lights; Appleton, Wis., 1,600 lights; Davenport, Ia., 1,600 lights; Watsontown, Pa., 500 lights, and Danville, Pa., 1,600

lights. The company is negotiating with thirty other towns.

An Electric Light Consolidation.—A meeting was held at the office of the Lowell telephone syndicate in that city on July 23. There were present Messrs. Wm. A. Ingham and Loren N. Downs, representing the Weston Electric Light Company of Lowell, Edward H. Goff and William Hovey, representing the American Electric and Illuminating Company of Boston, and the Middlesex Electric Lighting Company of Lowell was represented by its president, Mr. Geo. W. Fifield. The result was an agreement whereby all of the plants and business of the Weston company in Lowell are to be transferred to the Middlesex Electric Light Company, which will substitute lamps and dynamos of the "American" or Thomson-Houston system for those of the Weston. The Weston Company in Lowell will close up its affairs and surrender its charter. Messrs. Ingham and Downs were chosen directors of the Middlesex company. In this way a fierce struggle between the rival systems has been harmoniously adjusted.

Another Carbon Infringement Suit.—Suit has been begun in the United States Circuit Court at Cleveland by Charles F. Brush and the Brush Electric Light Company against George B. Senter and W. H. Boulton, copartners under the firm name of the Boulton Carbon Company, for infringement of patents held by the plaintiffs. The plaintiffs represent in their petition that three patents were obtained by Mr. Charles F. Brush, one on the carbon rod or stick, used in the electric light, and the mechanism for making the same; one on a process for baking carbon rods, and one on a process and apparatus for straightening carbon rods. The right to manufacture and prepare carbon rods under these patents was given to the Brush Electric Company by Charles F. Brush, the inventor, on the payment of a royalty to him by the Brush company, and such right has been given to no other person or company, but the plaintiffs claim that the Boulton Carbon Company has been infringing upon these patents and illegally carrying on such manufacture by the process invented by Mr. Brush. They therefore ask that the defendants be enjoined from the construction, sale, or use in any manner of these patented improvements, that they be compelled to account for the profits or income derived from the construction, sale, and use of such process that they have carried on in the past, and pay the plaintiffs damages on account thereof. The usual list of interrogatives following petitions in patent cases, which must be answered by the defendants, is attached to the petition.

The Brush-Swan Company's First Installation.—On the 31st ult. the Brush-Swan Electric Light Company began lighting up the Central National Bank, at Broadway and Leonard streets, this city, with small incandescent Swan lamps, fed from storage batteries furnished by Mr. Brush. This company promises to do for the interior of buildings what the Brush Electric Light Company has done for the streets. The lamps were made in Boston under an agreement with the English Swan Electric Light Company. The batteries were made in Cleveland. The Swan lamp is similar in essential features to the Edison lamp—a glass bulb having a carbon filament which is heated to incandescence by the electric current, air having been exhausted from the bulb. When the exhibition was given at the company's offices in December, it was said by the officers of the company that batteries would be manufactured by the hundred at once, and the incandescent light offered at the price of gas. Some contracts were made to introduce the light, but the company has delayed the work until it may be winter before the batteries begin to arrive here in any number. The Central Bank was one of the first to make an agreement for the new light. It is as satisfactory as was the light shown at last winter's exhibition, being bright and perfectly steady. The batteries are contained in long, coffin-like boxes, which may be placed in any convenient spot; they are fed by wires running from the street poles of the Brush Company, the same wire doing service either for feeding an arc street light or charging a house battery. This installation is the first that has been made by the Brush-Swan Company. The Madison Square Theatre expected to have lights of this system working by the first of last June. The fixtures have been in place since May, but the batteries only arrived last week. One cause of this delay is said to have been Mr. Brush's desire to devise some method by which the lights could be diminished or increased in brightness for theatrical purposes without wasting the current from the storage batteries. He is said to have succeeded in this, and the system will be, according to the company's officers, in working order before the end of August.

MISCELLANEOUS NOTES

An Undisputed Assertion.—It requires just as much ingenuity to make money out of an invention as to make the invention.—*Edison.*

The Electric Current of a Proposal.—"Do you fear lightning, Miss Fitzjoy?" inquired De Maurice, tenderly, as he saw the gathering storm in the west. "Y-e-e-s, I am somewhat frightened. But the lightning never seems to strike me, although most of the girls of my very set are engaged." With a hint like that what could De Maurice do but turn on the electric current of a proposal? The wedding thunder is being rehearsed by the Bavarian Band.—*Hartford Post.*

Reeling Silk by Electricity.—M. Serrell, of this city, has just received the gold medal of the Lyons Academy for his invention for the automatic reeling of silk by electricity. He went to Lyons some years ago and got some capitalists there to accept his invention, which will work much the same revolution as was accomplished by the cotton gin. The reeling of silk from cocoons will, by means of this new machine, now become possible in the United States, where hitherto the costliness of labor was an insuperable barrier.

An Electric Boat.—A second electric boat, forty-six feet in length and capable of carrying fifty passengers, has just been launched on the Thames. The motive force lies concealed in seventy boxes, each of one horse-power, stored under the floor of the boat, and at the end there is a Siemens dynamo, the spindle of which is continued so as to form the screw, without intermediate gearing. A speed of nine miles an hour can be maintained for six or seven hours, when the secondry batteries have to be replenished. There is no noise, or heat, or smoke, or smell, or waste, and the machinery takes up so little room that practically the entire boat is available for passenger accommodations.

The Vienna Exhibition.—So many applications for space at the Vienna Electrical Exhibition have been made recently that the huge buildings bid fair to be overcrowded, and, contrary to original intentions, another large court has been prepared for the placing of exhibits. Various governments have asked officially for space, among them being those of Belgium, of Denmark, for military and naval appliances; of England, for postal and telegraphic systems; of France, for military, naval, commercial, postal, telegraphic and educational exhibits; of Italy and Turkey, for telegraph systems, and of Russia, for telegraphs and naval appliances.

Curious Lightning Effects.—On the evening of the 28th ult. a severe thunder storm visited the vicinity of Shelter Island, this State. No damage was known to have resulted, however, until Sunday morning about ten o'clock, when fourteen cattle were discovered prostrate in a field not far from the Manhasset House. Upon examination they were found to be dead. A few square feet of bark were torn from a tree in the same field, and there were slight traces of electricity in the grass, but no mark of any kind on the dead animals. The carcasses were scattered about in the field at considerable distances apart, many of them not near the tree. How they were all killed by the same stroke is mysterious.

Stock Quotations.—Telegraph, telephone and electric light stocks were quoted on Wednesday of last week and Wednesday of this week as follows:

	July 25.	Aug. 1.
American Cable	....	66½
Bay State Telephone	119	....
Bell Telephone	270	272½
Bankers and Merchants' Tel	....	123
Currier Telephone Bell Co	....	20
Granite State Telephone	....	85
Mexican Telephone Co	....	2½
Mutual Union Telegraph	....	19
National Bell Telephone of Maine	80	80
People's Telephone	....	8½
Suburban Telephone Co	130	130
Tropical Telephone	2	2
Western Union Telegraph	80¼	80¼

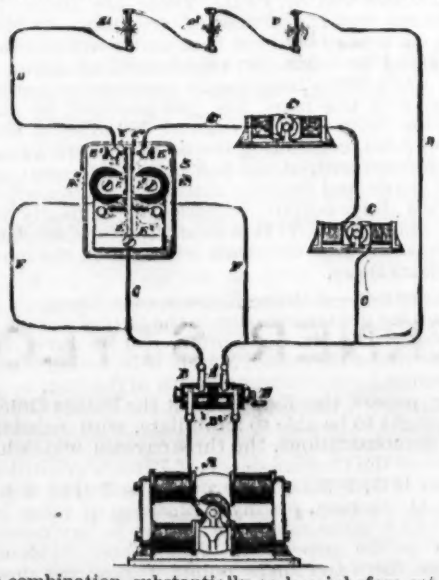
A Five Hundred Dollar Electric Bolt.—During a recent storm in Indianapolis which, as the learned reporter always says of a plain old-fashioned thunder-storm, was "accompanied with considerable electrical disturbance," lightning danced a particularly lively jig on a lightning rod and telephone wire at Mount Jackson, a suburb of the city. It struck the lightning rod of the west end of the Baker House and divided, a portion tearing off ten feet square of the roof, and passing down tore through the ceiling into the club room, where it spent its force. Another portion ran down to the telephone wire and from there into the bar-room, an apartment 16 by 20 feet, where it caused sad havoc. Every door and window opening into the room was broken, together with the bar fixtures, looking-glass, clock, etc.; and the current then tore down a hole through the corner into the brick basement. Still another portion ran along the water pipe on the north end, and entering the kitchen spent its force into the cupboard casing, which was considerably torn up. Three inmates of the house were badly shocked, but no one was injured.

Electricity's Future Uses.—A writer in *Cassell's Family Magazine* says it is easy to foresee that we are now entering upon a time when electricity will be introduced for useful service into almost every home, even the humblest. The electric light is destined to be one of the illuminants of the future, in one form or another; and with the supply of the electric current for lighting purposes throughout a town or village will come a great many other applications of it; the ringing of electric bells, and the working of such devices as fire and burglar alarms. There is, indeed, no end to the things which may be done by electricity, once it is supplied to houses like gas or water; for it is the most versatile of all the forces, and can be employed at will to generate heat, light, chemical decomposition and mechanical power. The self-same current which lights our lamp will boil our kettle, plate our spoons and drive our sewing machine. It will tell us if fire has broken out in any room, if frost is too severe in the conservatory, if the water-level is too low in the cistern. It will regulate our clocks, call our servants within the house, or bring assistance from without; and it will guard us from the nocturnal intrusion of any visitor who has a fancy for our valuables and no acquaintance with the family.

ELECTRICAL PATENTS ISSUED

And Dated July 24, 1883.

Automatic printing telegraph; Francesco Ostrogovitch, Florence, Italy 281,788
Automatic cut-out for electric circuits; Robert J. Sheehy, New York 281,799
Automatic electric switch; Henry W. Spang, Reading, Pa 281,937



2. The combination, substantially as hereinbefore set forth, of the shunt-circuit of an electric generator, the coils of a polarized magnet included in said shunt-circuit, the vibrating armature of said polarized magnet, and two main circuits, one closed about the poles of said generator by said armature on its forward stop, the other closed by said armature on its back stop.

3. The combination, substantially as hereinbefore set forth, of a line of conductors equipped with electric lights, a second line of conductors equipped with devices other than electric lights, the shunt-circuit of a generator, the coils of a polarized magnet included in said shunt-circuit, and the polarized armature for closing one or other of said lines of conductors about the poles of said generator.

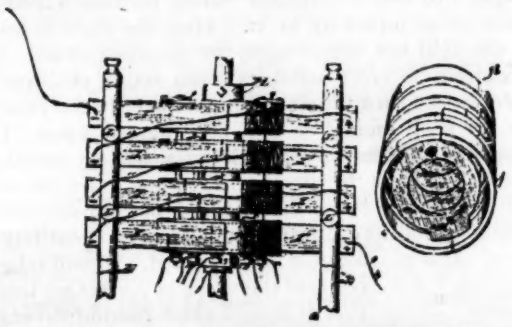
4. The combination, substantially as hereinbefore set forth, of a generator of electrical currents, a pole-changer, a closed shunt-circuit, the magnetizing coils of a polarized magnet included in said shunt circuit, the polarized armature, the two limiting-stops of said armature, and the two lines of main conductors independently and respectively closed about the poles of said generator by said armature.

Carrier for underground wires; Theodore A. B. Putnam, New York, N. Y. 282,010
Dynamo and magneto-electric machine; John M. McMahon, Jersey City, N. J. 281,904

Claim.—1. The combination of a dynamo or magneto machine with one or more fusible plugs interposed in the circuit of said machine between the armature and the commutator, substantially as described.

2. The combination of a dynamo or magneto machine with one or more fusible plugs interposed in the circuit of said machine between the field magnet and a brush connected with the commutator, substantially as described.

Dynamo-electric machine; Edgar A. Edwards, Cincinnati, O. 281,985



Claim.—1. In combination with the armature of a dynamo-electric generator, a commutator composed of duplex segments of rings upon diametrically-opposite sides of the shaft, insulated from each other at the two neutral lines, and having a segmental shunt-branch, *k l*, forming a portion of the commutator-surface on each side of the two neutral points, so as to shunt the current in the coil connected thereto before, and continuing until after passing the neutral line, and forming a tranverse, branch circuit through the commutator without cutting the coil out of circuit, substantially as described.

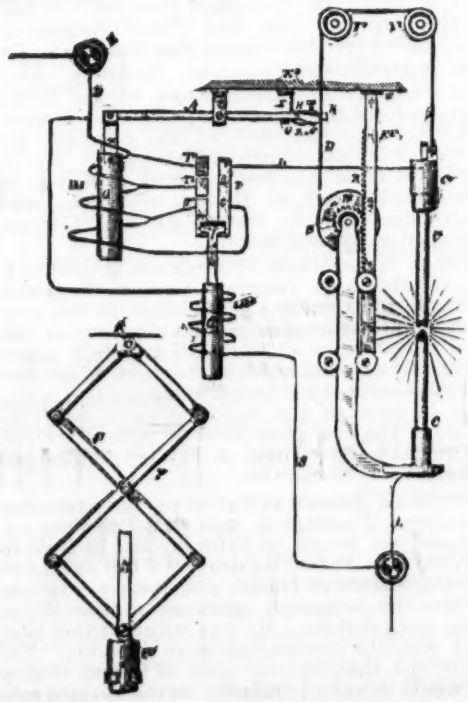
2. In combination with an armature having a series of induction-coils, a series of duplex segmental commutators *i j*, each provided with segmental shunt-branch *k l*, forming a part of the commutator-surface on each side of the neutral lines and in juxtaposition with each end of both sections *i j*, the terminals of each coil being connected, respectively, with sections *i* and *j* in series, so that the terminals of each coil are brought into shunt-connection with the branch *l* before, and continuing until after it passes the neutral point, thus shunting the current in said coil, the branch *z* forming a shunt for the remaining coils during said period of reversals, maintaining at all times the several coils in continuous closed circuit, substantially as described.

3. In combination with an armature having a series of induction-coils, the terminals of which are severally connected to commutator-sections *i j*, having the shunt branch connectors *k l*, two series of brushes, *I I'*; the whole connected in serial circuit, so that the terminals of each coil are brought into metallic connection with the branches *k l* before, and continuing until after passing the neutral lines, and the current of remaining coils are shunted through the same branch *k l* during said period, thereby maintaining all of the coils at all times in continuous closed circuit, substantially as described.

Electric railway; Francis B. Crocker, Charles G. Curtis and Schuyler S. Wheeler, New York, N. Y. 281,672

Claim.—The combination, with an electric railway train, substantially as set forth, of a continuous electrical conductor extending through the train and electrically connected in the locomotive to a device whereby it may be put in electrical connection with one of the current-supplying conductors of the track, electric brakes acting upon the wheels of the cars and adapted to be operated by electric currents which are conveyed to them through secondary branch circuits derived from the said continuous or main branch conductor extending through the train, the said secondary branch circuits being separately connected in each car to connecting brushes, wheels, or other devices in electrical connection with the other current-supplying conductor of the track, and means whereby the strength of current flowing through the said brakes may be controlled, substantially as described.

Electric fire-alarm and call-bell system; Chas. Henry Frank, Amsterdam, N. Y. 281,680
Electric arc-lamp; Nathaniel S. Keith 281,698
Electric light regulator; Robt. J. Sheehy, New York, N. Y. 281,800



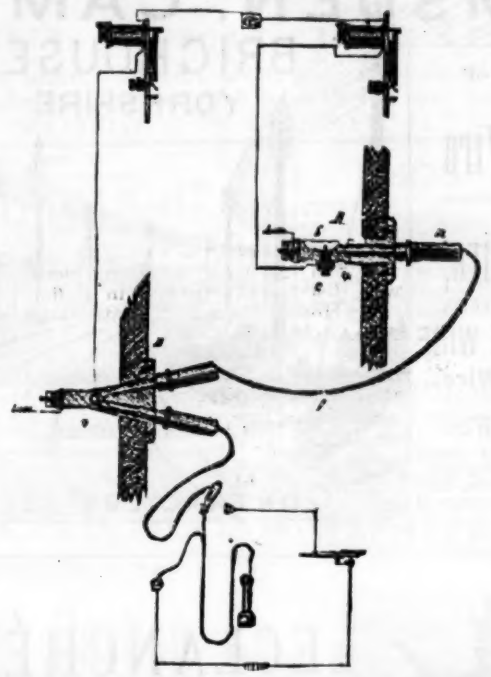
Claim.—1. The combination, substantially as hereinbefore set forth, of the electrodes of an arc-lamp, the regulating electro-magnet thereof, a clamping mechanism for subjecting said electrodes to the action of said regulating electro-magnet, and an automatic switch operating to shunt from the main circuit more or less of the conductor comprising said helix.

2. The combination, substantially as hereinbefore set forth, with the electrodes of an arc-lamp, the clamping device, and the electro-magnet in the main circuit for controlling and operating said clamping device, of an electro-magnet in a shunt-circuit spanning the electric arc, and a switch operated thereby for short circuiting more or less of the main-circuit wire in the helix of said regulating magnet correlatively with variations in the resistance of the arc.

3. In an electric-arc regulator, the combination, substantially as hereinbefore set forth, of the regulating electro-magnet, the helix thereof, contact-points respectively connected to the conductor forming said helix at different points, a contact-plate connected to the main circuit of conductors, a traveling circuit-closer or bridge for connecting one or more of said contact-points directly to said contact-plate, and an electro-magnet situated in a shunt-circuit spanning the arc for impelling said switch or bridge.

4. The combination, substantially as hereinbefore set forth, of the supporting mechanism of the electrode of an arc-lamp, a regulating electro-magnet, its armature-lever provided with a shoulder, a clutch mechanism combining a tongue or clamp pivoted to said lever, a spring maintaining said tongue to a position to bind or press said supporting mechanism against said shoulder, and a contact-stop for arresting the upward movement of said tongue.

Electric temperature indicator; Robt. Hewitt. Jr., New York, N. Y..... 281,877
Electric tele-thermoscope; Warren S. Johnson, White-Water, Wis..... 281,884
Electric-arc lamp; John Lea, London, County of Middlesex, England..... 281,891
Electric call apparatus; Charles S. Shivler, Brooklyn, N. Y..... 281,931
Electric annunciator and fire-alarm; Samuel Van Benschoten, Brooklyn, N. Y..... 282,016
Insulated electric conductor; Alfred A. Cowles, New York, N. Y..... 281,841
Insulating compound for electrical conductors and apparatus for compounding and applying the same; J. Burrows Hyde, New York, N. Y..... 281,999
Spring jack switch for telephone exchanges; James C. Warner, Chicago, Ill..... 281,741



Claim.—The combination in a spring jack switch, of the frame *a* provided with a plug-hole of considerable depth, with the spring *b*, contact *c*, and plug *d*, substantially as and for the purpose specified.

Lightning arrester for electric wires; Wm. R. Patterson, Chicago, Ill..... 281,723
Manufacture of insulated electric conductors; Jos. F. Gilpin, Ansonia, Conn..... 281,864
Railway electrical circuit coupler; Palmer C. Ricketts, Troy, N. Y..... 281,730
Railway pneumatic switch and electric indicator; Charles A. Cooper, Pittsburg, Pa..... 281,839
System of laying subterranean electrical conductors; Wm. R. Patterson, Chicago, Ill..... 281,722
Transmitting apparatus for telephone lines; Thomas D. Lockwood, Malden, Mass..... 281,895
Manufacture of insulated electric conductors; Jos. F. Gilpin, Ansonia, Conn..... 281,864

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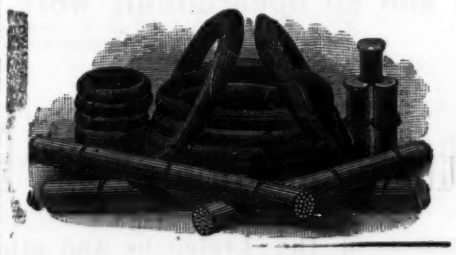

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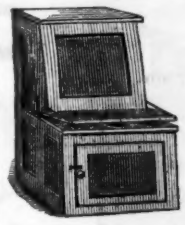

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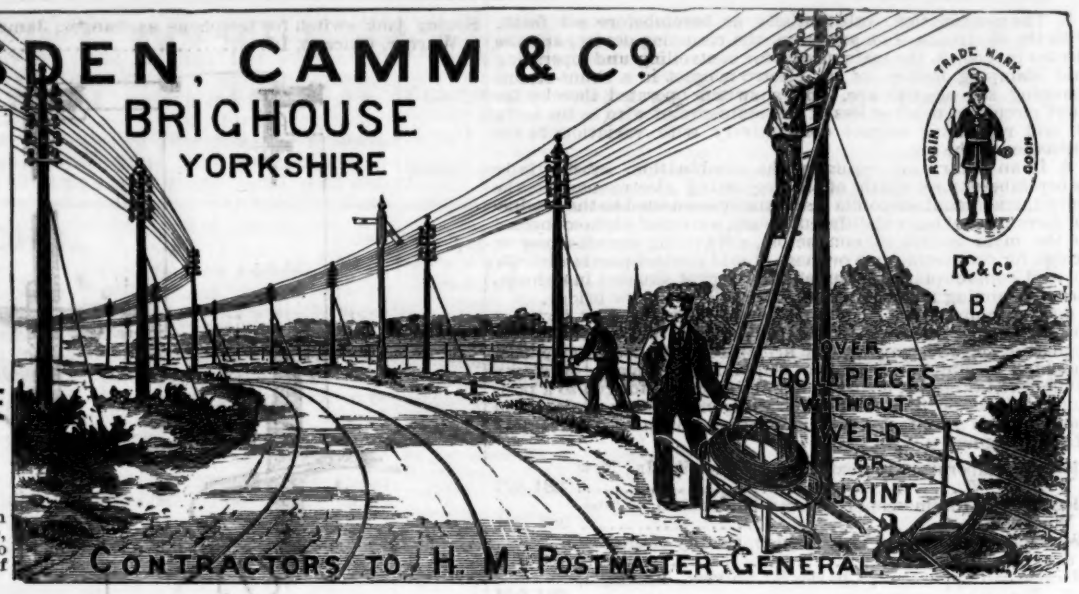

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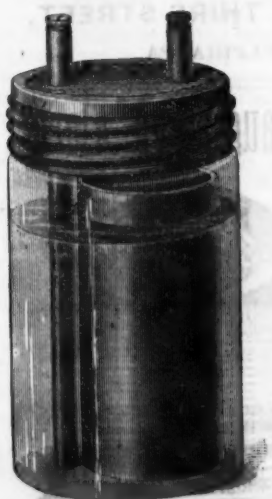

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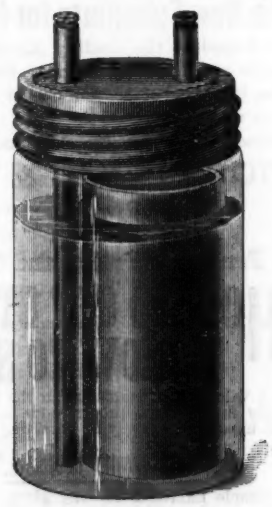

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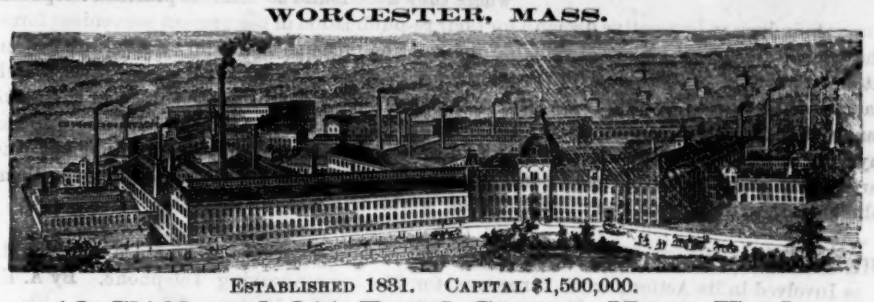

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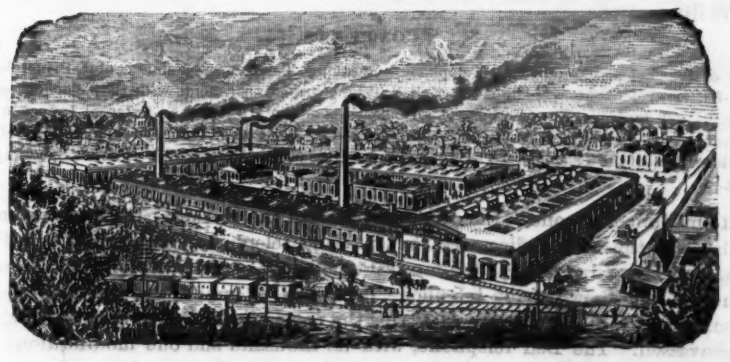

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The chapters of which this book is composed were originally published in THE OPERATOR, where they were found so useful to practical telephone men as to induce an imperative demand for their re-publication in the present convenient form. The book, while giving a mass of valuable information, such as could only be acquired by an extended practical experience with the telephone, is written in an easy, chatty style, which makes it entertaining reading. It is the only book that contains a description of the Blake transmitter, now used almost universally throughout the United States. No one who has anything to do with telephones can fail to find in it something of interest or value; but it is particularly useful to the managers and employés of telephone exchanges, as it gives them valuable instruction about every detail of their work.

THE TELEPHONE. An Account of the Phenomena of Electricity, Magnetism and Sound, as Involved in its Action; with Directions for Making a Speaking Telephone. By A. E. DOLBEAR. Second Edition. 18mo, cloth, 17 illustrations. Boston, 1883. 50c.

CONTENTS.

Electricity—Magnets—The Galvanic Battery—Other Means for Generating Electricity—What is Electricity?—Sound—Correlation—Reiss, Gray, Bell and Dolbear Telephones—How to Make a Telephone.

A very interesting little volume, which clearly explains the fundamental principles of the telephone in an able manner. The first edition had a large sale, and the demand for the book still continuing, a second edition has just been issued at a reduced price.

THE TELEPHONE. A Lecture by PROF. ALEXANDER GRAHAM BELL, Delivered before the Society of Telegraph Engineers. 8vo, paper, 30 illustrations. London, 1870. 60c.

This is a complete and concise account of the stages of experimentation gone through by Professor A. Graham Bell, before his researches resulted in one of the greatest triumphs of modern science. All who believe Bell to be the original inventor of the speaking telephone should have a copy of the work from which to quote. All who believe that he was not, should have one, so as to acquaint themselves with what can be advanced in support of the claims made for Bell. In fact, everybody interested in telephony should read it.

THE TELEPHONE, THE MICROPHONE, AND THE PHONOGRAPH. By COUNT DU MONCEL. Authorized Translation, with Additions and Corrections by the Author. 12mo, cloth, 70 illustrations. $1.25.

CONTENTS.

History of the Telephone—Musical Telephones—Speaking Telephones—Fundamental Principles of Bell Telephone—Battery Telephones—Modification of Bell Telephones—Experiments with the Telephone—Other Experiments with the Telephone—The Microphone—Applications of the Microphone—External Influence on Telephonic Transmissions—Establishment of Telephone Station—Call-Bells and Alarums—Applications of the Telephone—Various Uses of the Telephone—The Phonograph—Uses of the Phonograph—Faber's Speaking Machine—Appendix.

Count Du Moncel's is one of the cheapest books in the market. In his accustomed easy and popular style the author discusses the speaking telephone. Beginning with the Reiss telephone, and giving due place to the musical telephones of Wray, Pollard and Garnier and Varley, and the well-known string telephone, or lovers' telegraph, the magneto telephone of Bell is reached and fully described. After this the respective claims of Gray and Bell are impartially canvassed. The Bell telephone, with its thousand and one modifications, the battery telephone and microphone, with the adaptations of both to oral communication, pass before the reader in turn. A chapter is devoted to disturbances which appear on telephone wires, and another to the phonograph. Those who can only afford one book on the telephone, should make a point of securing this one.

THE SPEAKING TELEPHONE, ELECTRIC LIGHT, AND OTHER RECENT ELECTRICAL INVENTIONS. By GEORGE B. PRESCOTT. 8vo, cloth, 319 illustrations and 1 plate. New York, 1879. $4.00.

CONTENTS.

The Speaking Telephone—Bell's Telephonic Researches—The Telephone Abroad—History of the Production of Galvanic Music—Gray's Telephonic Researches—Edison's Telephonic Researches—Electro-Harmonic Telegraphy—Dolbear's Telephonic Researches—Improvements of Channing, Blake and others—The Talking Phonograph—Quadruplex Telegraphy—Electric Call Bells—The Electric Light—Edison's Recent Telephonic and Acoustic Inventions—Duplex Telegraphs, Electro-Magnets and Electric Time Service.

This is a large and handsome work, the object of which is to furnish the public with a clear and accurate description of the more recent and useful improvements in electrical science, and especially to explain the principles of that marvelous production, the speaking telephone. The most interesting portion of the work, to most readers, is the history of the original telephonic researches of Bell, Gray and Edison, the account of each inventor's experiments being given in his own words. It contains also a very thorough description and explanation of the quadruplex telegraph, with numerous diagrams, showing how the wires are arranged, and gives excellent accounts of the Brush, Maxim, Jablochkoff, Thomson-Houston, and other systems of electric arc lighting, with descriptions of the dynamos, etc. The illustrations throughout the work are very fine.

ELECTRIC LIGHTING.

ELECTRIC LIGHT, ITS PRODUCTION AND ITS USE; EMBODYING PLAIN DIRECTIONS FOR THE WORKING OF GALVANIC BATTERIES, ELECTRIC LAMPS AND DYNAMO-ELECTRIC MACHINES. By J. W. URQUHART, C.E. Edited by F. C. WEBB, M.I.C.E., etc. 8vo, cloth, 94 illustrations. London, 1880. $3.00.

CONTENTS.

Introduction—Voltaic Batteries—Thermo-Electric Batteries—Magneto-Electric Generators—Electro Magnetic Electric Machines—Dynamo-Electric Machines—General Observations on Machines—Electric Lamps and Candles—Measurement of Electric Light—Mathematical and Experimental Treatment of the Subject—Application and Cost of the Electric Light.

A very convenient and complete treatise on the electric light. The principles are defined in a manner devoid of technicalities, so as to render the book very valuable to the beginner. The history of the dynamo-electric machine and its development, from the Pixii to the Gramme machine, is also quite complete. The recent types of machine receive a full share of attention and the various styles of lamps are treated in full.

ELECTRIC LIGHTING. Translated from the French of LE COMTE TH. DU MONCEL, by ROBERT ROUTLEDGE, B.Sc. Crown 8vo, cloth, 76 illustrations. London, 1882. $1.25.

CONTENTS.

General Considerations—Generators of Electric Light—Electric Lamps—Cost of Electric Lighting—Applications of Electric Light—Conclusion—Notes and Appendices.

A translation of the work of this prolific writer on electrical subjects, published at Paris, in 1880, under the title of "L'Eclairage Electrique," to which the translator has added brief accounts of the apparatus connected with electric lighting which have been brought forth since the publication of the original edition, viz., Swan's, Maxim's, Edison's, and Fox-Lane's incandescent lamps, and the Faure secondary battery. To the student or the general reader who desires information free from abstruse technicalities, and at an insignificant cost, on a subject that is attracting general attention, this work, the original of which is one of a popular science series, can be recommended. The object held constantly in view by the author was to make the treatise thoroughly practical. The book is the cheapest one that aims to cover the whole ground of electric lighting.

ELECTRIC LIGHTING AND ITS PRACTICAL APPLICATION; WITH RESULTS FROM EXISTING EXAMPLES. By J. N. SHOOLBRED. 8vo, cloth, 5 plates. London, 1879. $2.00.

CONTENTS.

Historical and Descriptive—Electric Light Machines—Lamps and Regulators—Carbons; Conducting Wires—Motive Power—Luminous Intensity—Applications; Economic Results—Prospects of Electric Lighting.

A handy little treatise, very valuable to the beginner. The author adopts a popular method of treating the subject and avoids technicalities as much as is compatible with the precision of the work. The history of the early efforts in this field is given, the apparatus being briefly described in each case. The notice of recent inventions, up to the date of print, is quite complete. The questions of power and of photometry form the subjects of very interesting and instructive details.

USEFUL INFORMATION ON ELECTRIC LIGHTING. By KILLINGWORTH HEDGES, M.S.T.E. Fourth Edition, Revised and Enlarged. Crown 8vo, cloth, 20 plates. London, 1883. $1.75.

CONTENTS.

Production of Electricity—Voltaic Arc—Division of the Electric Light—Machines or Generators—Power required, and Motors—Application of the Electric Light—Choice of a System—Setting to Work—Cost of Working—Measurement of Light and Current—Storage of Electricity and Transmission of Power—Electrical Measurement of Work—Useful Memoranda.

The first edition of this work met with so great a success as to encourage the issue of enlarged second and third editions, which have in turn been exhausted. A fourth edition, still further enlarged, has just been issued.

ELECTRIC LIGHTING BY INCANDESCENCE, AND ITS APPLICATION TO INTERIOR ILLUMINATION. A Practical Treatise. By WILLIAM E. SAWYER. 8vo, cloth, 96 illustrations. New York, 1881. $2.50.

CONTENTS.

Introduction—Generators of Electricity—Generators of the Gramme Type—Generators of the new Siemens Type—Incandescent Lamps—Carbons for Incandescent Lighting—New Forms of Lamps—Preservation of Incandescent Carbons—Division of Current and Light—Regulators and Switches—General Distribution—Commercial Aspects.

This book is an indispensable addition to the libraries of all who desire to keep up to the age in the novelty of electric lighting. Its author neglects the arc light altogether, and gives his readers a graphic account of the generators employed in the production of the necessary currents; of those lamps which utilize the currents when generated; of the most advantageous circuit arrangements and apparatus, and of the best materials to use in lighting by incandescence. A historical sketch shows that the idea of electric lighting by incandescence is as old almost as telegraphy itself. The book is handsomely printed and copiously illustrated.

INCANDESCENT ELECTRIC LIGHTS, WITH PARTICULAR REFERENCE TO THE EDISON LAMPS AT THE PARIS EXHIBITION. To which is added The Economy of the Electric Light by Incandescence, by JOHN W. HOWELL; and On the Steadiness of the Electric Current, by C. W. SIEMENS. Illustrated. 18mo, boards. New York, 1882. 50c.

There is no book that contains more valuable information in the same space than this On the question of incandescent lights it must be considered the best authority at present accessible. The tables and data given help very much in analyzing facts and making comparisons. The article by Mr. C. W. Siemens is especially valuable and interesting. It refers to a new method of exciting the field of dynamo-electric machines, which enables the current to maintain itself constant in the external circuit, no matter how great and rapid the variations of resistance may be. This method has come into use as a most valuable adjunct in the dynamos intended for incandescent lamps, where it enables any of the lamps to be put on and off at will without affecting the rest. For this reason this article is of great interest to every person interested in electric lighting.

VARIOUS APPLICATIONS.

ELECTRO-MOTORS. A Treatise on the Means and Apparatus employed in the Transmission of Electrical Energy and its conversion into Motive Power. By J. W. URQUHART. 12mo, cloth, illustrated. London, 1882. $3.00.

CONTENTS.

Introduction—On the Dynamical Nature of Electric Currents—Electrical Measurements—Electro-Magnetic Force—Electro-Magnets and Armatures—Electric Accumulators or Magazines—The Construction and Efficiency of Electro-Motive Machines—Electric Railways—Minor Applications of Electro-Motive Energy—Fragmentary Information.

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ELECTRIC TRANSMISSION OF POWER; ITS PRESENT POSITION AND ADVANTAGES. By PAGET HIGGS, LL.D., D.Sc. Crown 8vo, cloth, 21 illustrations. London, 1879. $1.20

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Dynamo-Electric Machines—The Gramme Machine—The Brush Machine—The Wallace-Farmer and Siemens' Machines—Efficiency of Dynamo-Electric Machines—Practicability of Transmission of Power by Electricity—Efficiency of Coupled Machines—Comparative Efficiency of Various Machines—Other Theoretical Considerations—Conclusions.

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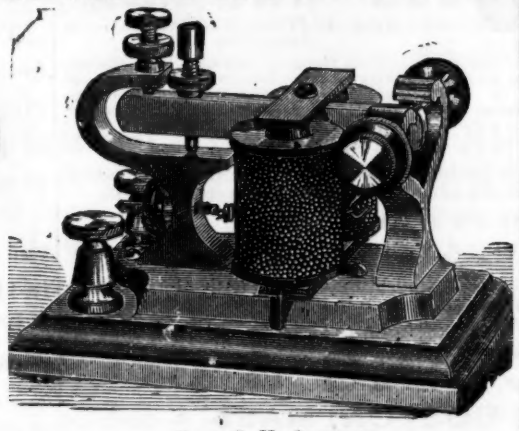

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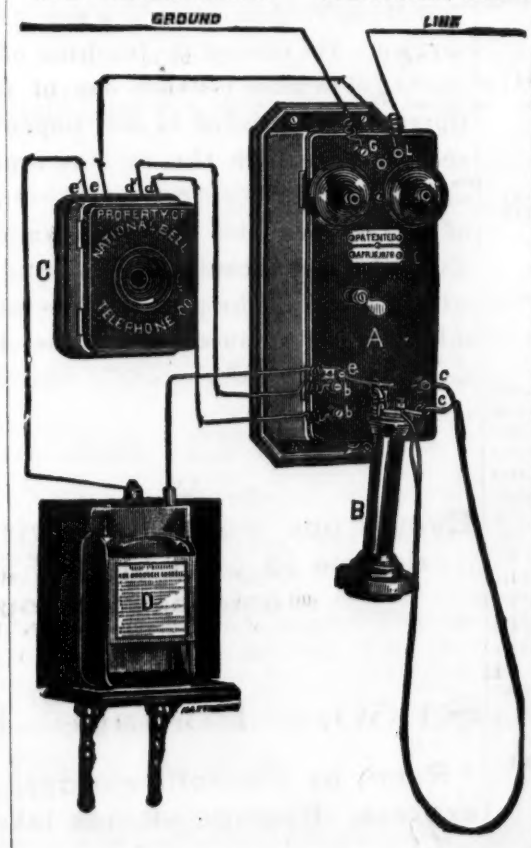

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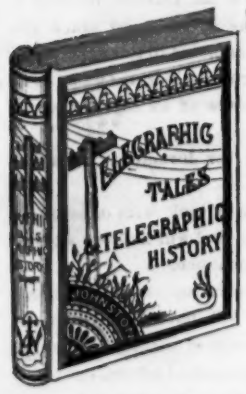

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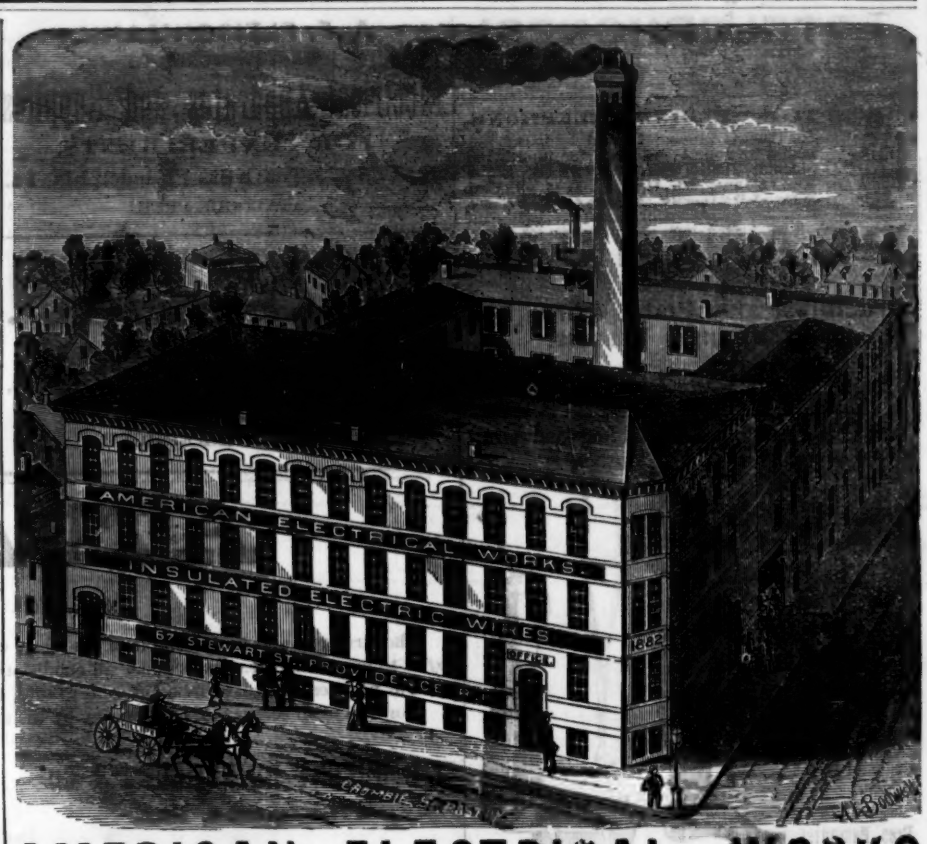

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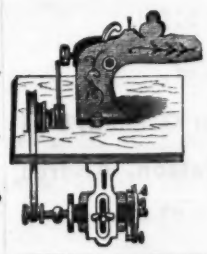

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